

MOTOR AGE

Volume XXXV
Number 23

PUBLISHED WEEKLY AT THE MALLERS BUILDING
CHICAGO, JUNE 5, 1919

Fifteen Cents a Copy
Three Dollars a Year

What Hudson Offers Dealers

Sixty thousand satisfied owners give the Super-Six advertising value that no other fine car enjoys. Sales for every month this year have exceeded the sales for the corresponding month in 1918.

The Hudson Super-Six is the largest selling fine car in the world. Its reputation for endurance, speed, and power is scarcely rivaled.

Note the kind of dealers Hudson has. They are everywhere the most prosperous. Their stores indicate the quality of the car they sell. They are the show places of the industry.

Only in handling a car that has the confidence-winning quality of the Hudson Super-Six could they prosper as they have.

For years Hudson had a hard time to keep production's pace with demand. We have now found it necessary to expand our factory. Additional facilities have been installed. Output will be increased. In the future our dealers will be able to share still greater profits.

To meet with our rapid expansion a few high-grade dealers will be added to our organization.

You know what the Hudson standard is. If you meet it, write now. This is an opportunity to share in the prestige and prosperity of the world's largest maker of fine cars.



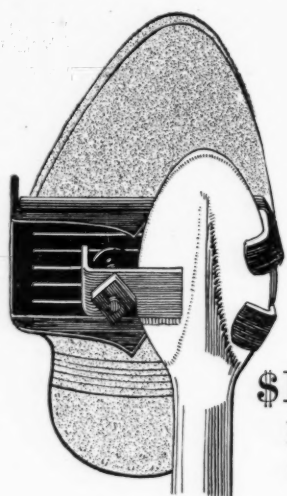
Hudson Motor Car Company

Detroit, Michigan

(G)

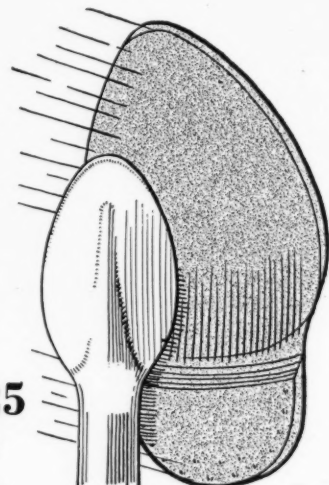


Look at These Illustrations



This
Driver's
Foot
Cannot Slip

\$1.25
Per
Set

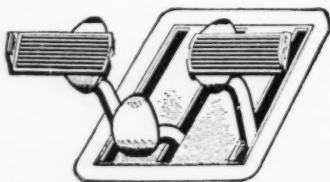


A
Slip Like
This Might
Wreck Your
Car

—and You Will See the Necessity for

UTILITY Pedals for Fords

•The key to safety in driving any Ford car, is a firm, positive grip on the pedals. UTILITY Pedals—rubber shod—are absolutely slip-proof. Besides, they are wide enough to hold the driver's whole foot—with a flange for extra protection against slipping, at the side. Owners call them "The Absolutely Necessary Accessory for Fords." Dealers find them selling faster every day, and increasing in popularity and profits, more and more.



How UTILITY Pedals
look from the front
seat of a Ford.

DEALERS: Order from your Jobber.

JOBBER: Get in touch with us.

Hill Pump Valve Company

Mfrs. of UTILITY Products

Archer Avenue and Canal St., Chicago

Sales Department:

THE ZINKE CO., 1323 S. Michigan Av.,
Chicago

MOTOR AGE

Published Every Thursday by

THE CLASS JOURNAL COMPANY

MALLERS BUILDING
59 E. Madison St., CHICAGO

HORACE M. SWETLAND, Pres. W. I. RALPH, Vice-Pres.
E. M. COREY, Treas. A. B. SWETLAND, Gen. Mgr.
Member Audit Bureau of Circulations; Member Assoc. Business Papers, Inc.

Vol. XXXV

Chicago, June 5, 1919

No. 23

CONTENTS

Copyright 1919 by THE CLASS JOURNAL COMPANY

What Indianapolis Race Showed	7
Resume of 500-Mile Sweepstakes, Which Proved a Plea for Smaller Cars.	
The Race from the Pits	10
The Log of the NC-4	16
Will France Keep U. S. Motors?	17
Editorial	18
News of the Industry	20
These Dealers to Pool Fordsons	21
Almost a Horseless Farm	22
Development	39
Bour Davis car, Craig Hunt cyl- inder head, Liberty camp trailer, Gray engine, Koehler truck and A-C speedometer described and illustrated.	

DEPARTMENTS

Garage Planning	26
Wiring Diagram Chart	29
Readers' Clearing House	30
Electrical Equipment	38
Maintenance Data Sheet	45
Monthly Car Specifications	46
Motor Car Repair Shop	49
Service Equipment	50
Accessory Corner	51
Among the Makers and Dealers	52
From the Four Winds	54

Advertisers' Index—Next to Last Page

MOTOR AGE

MALLERS BUILDING Phone Randolph 6960
CHICAGO Cable Address "Motage"

E. E. HAIGHT, Manager
DAVID BEECROFT DARWIN S. HATCH
Directing Editor Managing Editor

BRANCH OFFICES

DETROIT, 95 Fort St., W. CLEVELAND, 536-540 Guardian Bldg.
Phone Main 1351 Phone Main 1142
NEW YORK CITY, U. P. C. Bldg., 239 W. 39th St.
Phone Bryant 8760
PHILADELPHIA, Widener Bldg., Phone Walnut 5601

SUBSCRIPTION RATES

United States, Mexico and U. S. Possessions..	\$3.00 per year
Canada	5.00 per year
All Other Countries in Postal Union	6.00 per year
Single Copies	15 cents

Entered as second-class matter, September 19, 1899, at the
Post Office, Chicago, Illinois, under Act of March 3, 1879.

Owned by UNITED PUBLISHERS CORPORATION, 243 W.
39th St., New York, H. M. Swetland, Pres.; Charles S. Phillips,
Vice-Pres.; W. H. Taylor, Treas.; A. C. Pearson, Secretary.

"SIMPLY SHOOT IT
INTO THE CUT"

2 in 1 CUT FILLER

Is Easy and Quick to Sell

Every one of your car and truck customers will be interested in 2 in 1 Cut Filler. Sooner or later one or more of their tires will get a bruise, cut or gash. They know how small cuts, bruises and gashes eventually ruin the tires if not attended to at once. Order a display box containing tubes of 2 in 1 for your counter. Tell your customers all about 2 in 1 and what it will do for them.

Powerful Selling Points of 2 in 1

Cement and Rubber All In 1

2 in 1 is easy and quick to apply and helps to cut down tire bills—because it saves them and helps them deliver their full mileage. An extra, easy sale is almost sure to result. 2 in 1 Cut Filler is easily and quickly applied—keeps little holes from getting bigger—prevents formation of destructive sand and water pockets—keeps out fabric-rotting oil.

Other Dutch Brand Products

Get to know more about the complete line of profit making Dutch Brand Products. Send for our FREE colored catalog. Tells all about 2 in 1 Cut Filler—Auto Patching Cement—Rubber Seal—Vulcanizing Cement—Radiator Seal Compound—Carbo-Cide—Valve Grinding Compound—Auto Top and Cushion Coating—Gasket Shellac—Varni-Brite, and many others.

Dealers: Order Dutch
Brand Products
through your jobber.

Van Cleef Brothers

Manufacturers of Tire and
Chemical Specialties

Woodlawn Ave., 77th to 78th St.
CHICAGO, U. S. A.

DUTCH BRAND

TRADE MARK

Velie Six

Present Demand Exceeds All Expectations

THE call of the open road has added to the unprecedented demand for the Velie Six. Orders total more than double the number of Velie cars ever built before. All the facilities of the Mile of Velie Factory are required.

Country-wide recognition of the Velie values is responsible for this enormous increase. There is universal appreciation of the quality in the Velie car; of its beauty, of its high-grade features at a low price, and of the sincerity and honesty of purpose built into every model.

The Velie Six has the power, speed, comfort and dependability—every quality you want in the automobile you sell. Dealer and owner alike agree that the Velie Six offers greatest values for the price.

If Your Territory Is Open—Write Today

**VELIE MOTORS CORPORATION, 113 VELIE PLACE
MOLINE, ILLINOIS**

Builders of Automobiles, Motor Trucks and Tractors



\$1525

When Writing to Advertisers, Please Mention Motor Age



Wilcox, the winner, and the flying start of the race, showing everything but the speed and vibrations set up by a field like this when it gets under way. This calls for very cautious driving until the cars thin out

Race Is Plea for Smaller Cars

Victory Sweepstakes Won by Wilcox May Be Last 300-Cu. In. Classic On Hoosier Oval—Indianapolis to Lower Piston Displacement Limit to 183 Cu. In. Next Year

INDIANAPOLIS, IND., May 31—More noteworthy than the victory of Howard Wilcox driving a speedway-owned Peugeot in the 500-mile Victory race at Indianapolis to-day, by which the international sweepstakes honors were returned to America by a native driver, is the fact that future Indianapolis races will be for cars with smaller piston displacement. Carl Fisher, the moving spirit behind the brick oval, the first speedway in America and originator of the 500-mile classic, has come to the conclusion that 300-cu. in. cars are too speedy now for the track. He announced tonight that the speedway officials had decided to limit the cylinder displacement of the cars in the 1920 event to 183 cu. in. This is the 3-liter limit adopted for the French Grand Prix and the size to which all the new European speed creations will be built.

By Darwin S. Hatch
Managing Editor Motor Age

Boillot's Baby Peugeot is even smaller than this and ran well up until it turned over within twenty miles of the finish, when it was in third place.

Fisher's idea is that inasmuch as the Indianapolis track is maintained for the purpose of developing cars and to-day's race proves that the 300-cu. in. cars are too fast for it, its work is accomplished, so far as those are concerned. It is to the best interests of the industry now to use the track in the development of the smaller engines and lighter cars.

The fact that the adoption of European limit for next year's race will encourage European competition in that event and that that fact probably was not absent from the minds of the Indianapolis officials when they made their decision

does not lessen the advantage that will come to American racing and the American industry as a whole. Fisher is right in his decision that the cars are too fast for the Hoosier oval. To-day's race proved that. Incidentally it proved what is almost the converse, that the track is too rough for 500-miles at the speed the present cars are capable of.

Racing, it is assumed, is primarily for the purpose of developing and improving the cars in every-day use. There are many more cars in use having small displacement than 300-cu. in. Therefore, let's develop the small ones. When Indianapolis establishes a three-liter race, it is a certainty that other races will follow suit, particularly with the Grand Prix to back it up.

Wilcox's victory was not a victory of speed so much as it was a victory of preparedness, through acquaintance

How They Finished

Car	Driver	Prize
Peugeot....	Wilcox	\$20,000
Durant....	Hearne	10,000
Peugeot....	Goux	5,000
Ballot....	Guyot	3,500
Bender....	Alley	3,000
Packard....	de Palma.....	2,200
Frontenac..	Louis Chevrolet	1,800
Hudson....	Vail	1,600
Frontenac..	G. Chevrolet	1,500
Ballot....	Thomas	1,400

were for tires and supplies. He did not drive exceptionally hard, made no exceptionally fast laps. He won because others, who drove faster while on the track, could not keep going.

Goux's car is a Peugeot only in part. The engine is a Premier, which replaced the French engine broken up in practice.

The race this year did not hang up a record for the distance. Wilcox's time was not quite 7 min. greater than de Palma's record for the 500 miles in 1915. To-day's average speed was 87.95 m.p.h., 1.89 m.p.h. less than the 1915 record of 89.84 m.p.h.

If de Palma or Louis Chevrolet, who between them led the field for the first half of the race, could have kept up their pace, the track record for the distance would have been broken. De Palma led the field for the first 150 miles at an average or better than 92 m.p.h. His stop threw Chevrolet in the lead, and the speed dropped to 90 m.p.h. The Italian came to the fore again and hopped the pace up to 91.6 m.p.h. until an exhaust valve and front wheel bearing put him down in the ruck. His speed of 92.20 at the 100-mile mark is a track record for that distance.

Wilcox led through the entire last half of the race, taking the pace when the Packard was moored at the pits for re-



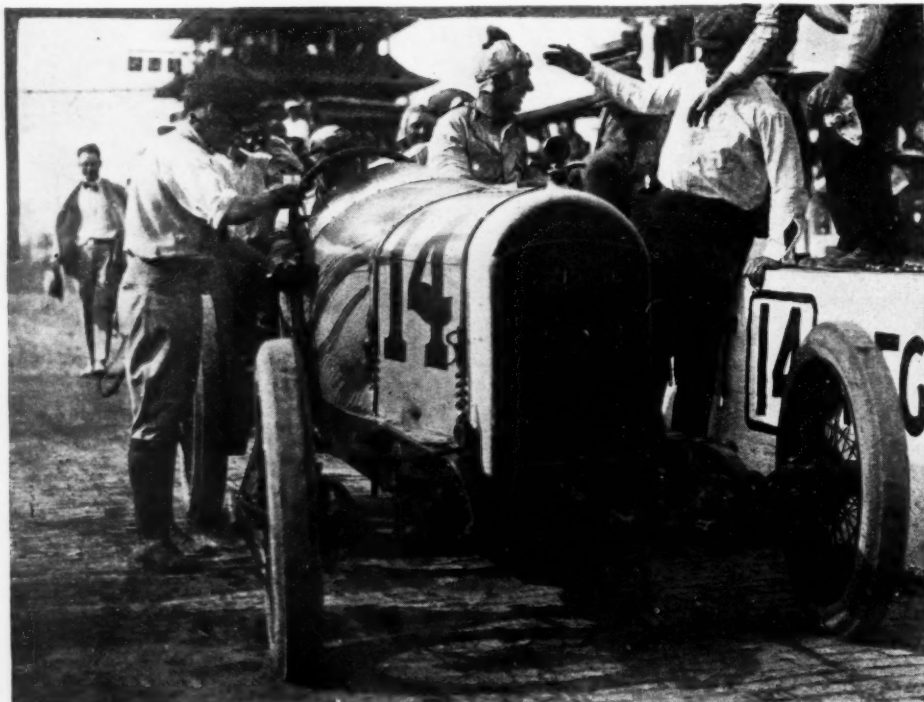
When this picture was taken the 500-mile had not been run, but no doubt the care Goux took in examining this connecting rod bearing surface helped him win third place

with the track and generalship—combined, as always, with good luck. The Peugeot which carried Wilcox under the wire a winner is the same car that the late Aitken campaigned so successfully. It has been worked over so much and new parts of American manufacture incorporated, so it is now not wholly foreign. Wilcox has it in such shape that he went through the race today without having to make any adjustments on it except that he had to tape the left front frame horn which had cracked during the latter part of the race. His three short halts at the pits



Goux again. Here he is examining the quality of his gears before the race, tapping them with a hammer and listening to the ring. The same care is shown here also

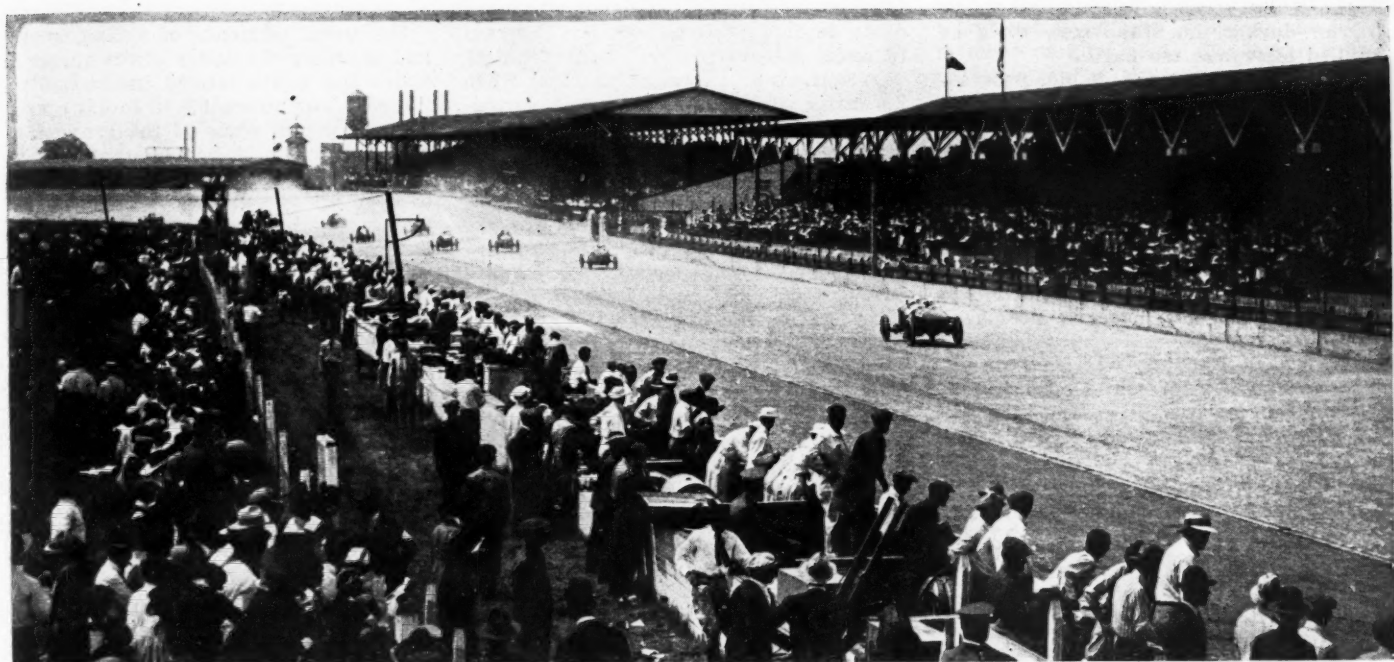
pairs. The Peugeot which the winner piloted was well up among the leaders most of the way. It was in third place at 25 miles and sixth at 50. Then Wilcox fell clear out of the money for nearly 50 miles but climbed steadily until at 125 miles he was back in third place and crowding de Palma and Louis Chevrolet. He took second place when the Frontenac hung up at the pits at 225 miles and was in position to take advantage of de Palma's difficulty at the



Eddie Hearne and his Durant Special at the pits after the race. Reports have it that this car is the old No. 5 Stutz driven by Gil Anderson



Referee Eddie Rickenbacker conferring with A. A. A. officials. Rick rode in the pacemaking car with Maj. Jesse G. Vincent



Wilcox made but three stops at the pits. These were for tires, gasoline and oil and in one, the last stop, he and his mechanic lashed a broken frame horn in place. The repair held, and Wilcox drove his mount at the same steady gait as before

halfway mark. This put Wilcox in first place with slight lead over Hearne and Cooper. The menace of the Stutz ceased, however, when the Californian stuck a valve but continued, slowly dropping behind while the engine thumped a wail of protest that could be heard half way around the track. Cooper was relieved by his mechanic.

By the time the race was within 60 miles of the finish, the field had divided itself into two sections. With Wilcox in the lead and only 5 miles ahead of Hearne, who was in second, and 14 miles ahead of Goux for third, Alley, Guyot and Louis Chevrolet at the wheel of Gaston's car were fighting for position. This bunch of six cars was 40 miles ahead of the rest of the field with Vail's Hudson and Boillot's Baby Peugeot fighting for the doubtful honor of leading the second contingent.

Headly Driving by Hearne

Eddie Hearne, who by heady driving, tooled his Durant Special into second money, finished less than 2 min. behind the leader. He made only two stops and these for supplies. Like Wilcox, Hearne scored by steady consistent driving. There never was a time during the race when he was not in the money, and he climbed till when the race was half over he was in second place and only 10 miles behind the leader. This was the status till Wilcox stopped to load up for the final dash, which gave Hearne a chance to pick up two laps.

The Durant Special which Hearne drove was entered by Clifford Durant, son of one of the big men of the industry, W. C. Durant. The car is the old Stutz that Gil Anderson drove, it is reported.

Another speedway-owned Peugeot captured third place under the piloting of Jules Goux, winner of the 1913 sweepstakes. Goux did not show among the

contenders until the race was about half over, but at 325 miles he had climbed into fourth place, jumping to third with 75 miles to go when the Frontenac got into difficulties. Goux only made five stops, all of short duration, and his car seemed to perform as well as ever.

Of the four Ballots started only two finished, but both in the money. Guyot captured fourth place and Rene Thomas, winner of the 1914 race, nosed into the purse for tenth place. The other two came to grief. Bablot's machine, with Chassagne, the former Sunbeam pilot, at the wheel, turned over. Louis Wagner's mount broke a wheel early in the day.

The Ballot cars, built especially for this race at an expense of \$120,000 and brought over from France with a crew of Europe's best drivers, did not come up to expectations. That they had speed was shown in practice and in the elimination trials. They did not stand the 500 miles on the bricks. Guyot only made three stops and these not of long duration. Thomas made five stops for supplies and tires. He seemed to be taking things very easy.

The real race was between Louis Chevrolet and de Palma for sixth and seventh places. Lap after lap they fought, de

PROPHECIES that motor racing never would come back into popular favor were adequately disproved by the attendance and enthusiasm at Indianapolis.

Estimates of the attendance varied all the way from 75,000 to 125,000. Which of these is correct, it is impossible to say, but vacant seats were few in the vast grandstand and bleachers, paddock and parking spaces were filled. Whatever the actual number of spectators the turnout was sufficient to show the interest in the public, in general, and the delegations from other cities by train and motor indicated that it was in no way localized.

Palma coming up from the ruck after changing a wheel bearing and Chevrolet fighting to make up the time lost in changing a steering knuckle, tie-bar and wheel. The battle brought the grandstands to their feet time after time—this after the race had been won. So close was the finish that only a re-check of the timing tape could determine who got in first. In the re-check, de Palma, who had been given sixth, unofficially, first was seventh and then sixth.

Alley's Bender Special entered by the Ahlberg Bearing Co., made a most consistent showing. Alley finished fifth. Eddie O'Donnell, who was forced to quit by engine trouble, showed his gameness by driving with one arm which had not completely recovered from his accident two years ago.

It appeared for a time that Hickey, in the Stickel Special had come in in the money, but the recheck of the tape disposed of that.

Frontenacs Not Too Light

Contrary to the general supposition the Frontenacs were not too lightly built for the Hoosier track. Louis Chevrolet in an interview with a *MOTOR AGE* representative, stated that inferior material had been used in place of what should have been chrome nickel steel. The right steering knuckle spindle which snapped off during the latter part of the race on Gaston Chevrolet's machine showed on the fracture every evidence of crystallization. The old knuckle which had been relegated to the Frontenac garage was brought out again and had it been used in the first place the accident would probably never have happened. The twisting off of the rear wheels is attributed to the construction of the hub shells on the wire wheels, which Chevrolet says must be modified to meet the light construction of the aluminum Frontenacs. Boyer's accident was due

to the severe strain given his brake shoe carrier during the brake test, when he applied his brake too hard.

The race was not one of bloodless aspect. There were three men killed, and the partner of the fourth may die. The Roamer, driven by LeCocq, entering the back-stretch on its ninety-sixth lap, had a disastrous accident. The gasoline tank exploded, the car overturned and the two men were killed instantly and their bodies cremated under the burning car. Arthur Thurman, driving his own car, was killed when it overturned after having gone about 110 miles. His mechanic, Robert Bandini, was badly hurt, suffering a fractured skull. Chassagne, relief driver for Bablot, was pushing the Ballot around its sixty-third time when

the car overturned. No one was seriously injured and the car was brought in under its own power. Louis Wagner narrowly averted a tragic accident when his car collided with the wall, swinging him out of his course somewhat, but he managed to keep the car under control and continued.

Still another name may be added to the list. When Louis Chevrolet threw a wheel in front of the grandstand toward the end of the race and tore out the timing wire with his scraping axle an end of the wire flew back and caught Shannon across the throat near the jugular vein. He continued for another lap, bleeding profusely and barely managed to make the pits before collapsing. He is in the hospital critically ill. His me-

chanic finished the race for Shannon.

The usual efficiency of timing, scoring and guarding the safety of the spectators which has characterized Indianapolis in the past was noticeable in to-day's event. Announcing in some of the grandstands was not up to previous standards and the scoreboards were sometimes not able to keep up with the race.

The fact that the timing wire was cut by a car which came in without a wheel and nearly decapitated a following driver suggested advisability of some means other than a wire under tension stretched across the track to operate the timer. Such a means, having permanent contacters, also might obviate the necessity of the short period of hand timing that was made necessary to-day.

The Race from the Pits

Analysis of Mechanical Troubles Met by Cars

SIXTY-SIX of the 106 stops at the pits of the 500-mile race were for tires, the old offenders. Fouled plugs were in evidence also on a good many jobs, but not to the extent that might have been expected, considering the high engine speeds. There were a lot of mechanical breakdowns that well might have been avoided had a little more time and attention been given to the preparation of the cars and engines. Take the Durant Special, which was forced out early in the race because the hose connections from top of engine to radiator were seemingly not properly made and had to be taped

By B. M. Ikert

Motor Age Editorial Staff

from time to time and the radiator wired to overcome vibration.

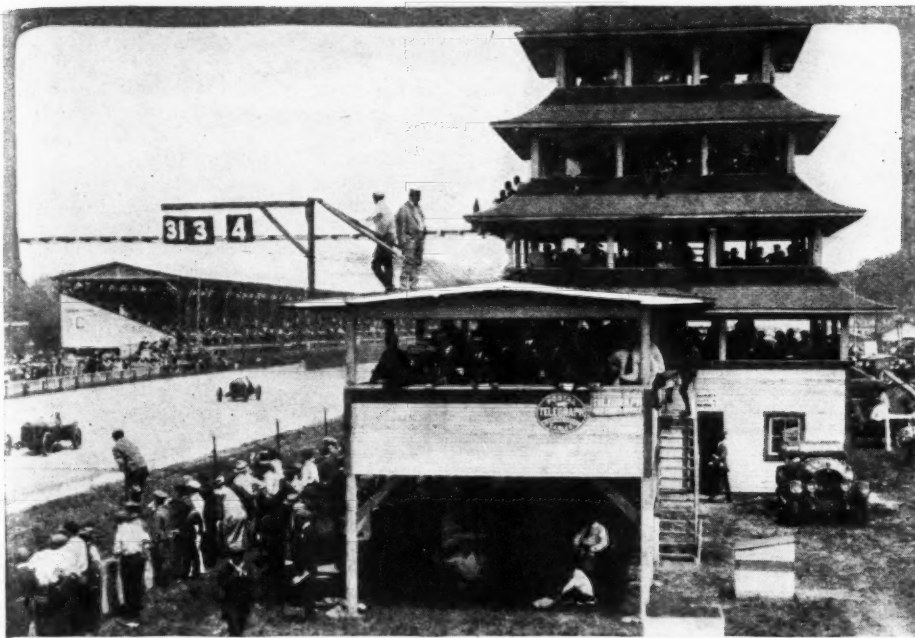
If there is such a thing as consistency in stopping at the pits, Howard in the Peugeot deserves first honors, as his mount had to be halted twelve times owing to oiling troubles. The mechanic's efforts to pump oil were to no avail, for there was no rise in the pressure system and the car had to be driven to the pits at regular intervals to supply the necessary pressure. Next to make the great-

est number of stops was the Hudson Special driven by Haibe, who drove up to the pits ten times. Nine stops were made by the Detroit Special due to everything from plug failure to an enormous desire of the cooling system for water.

Seven stops had to be made by Louis Chevrolet, whose fleet and lightweight Frontenac did not want to keep its rear and front wheels in their normal places. Chevrolet states that, due to light hub construction on the wire wheels and the quick getaway of the Frontenacs and their great speeds, it becomes a rela-

Official Times of Every Car for Each Ten

M.P.H.	NUMBER AND CAR	DRIVER	Lap 10	Lap 20	Lap 30	Lap 40	Lap 50	Lap 60	Lap 70	Lap 80
87.95	3—Peugeot.....	Wilcox	14:56.25	30:54.45	48:34.90	1:04:53.50	1:21:20.45	1:37:55.95	1:54:23.25	2:10:07.45
87.00	14—Durant.....	Hearne	15:13.90	31:15.55	47:56.85	1:04:57.45	1:22:10.90	1:40:28.55	1:57:26.45	2:14:24.70
85.90	6—Peugeot.....	Goux	15:25.00	31:41.30	52:01.89	1:09:11.90	1:26:24.70	1:43:35.70	2:00:58.60	2:18:50.45
84.35	32—Ballot.....	Guyot	15:08.85	31:08.95	47:45.35	1:04:20.90	1:21:13.90	1:44:56.30	2:02:00.90	2:18:51.15
82.20	26—Bender.....	Alley	17:15.05	33:46.75	51:29.45	1:08:38.90	1:26:10.80	1:43:38.45	2:00:39.50	2:21:58.45
81.05	4—Packard.....	De Palma.....	14:55.20	29:20.70	45:40.40	1:01:31.45	1:17:36.95	1:36:16.90	1:52:43.25	2:08:31.15
81.00	7—Frontenac.....	L. Chevrolet	15:05.70	29:29.90	46:01.65	1:02:32.50	1:18:59.80	1:37:01.70	1:52:23.90	2:09:16.15
80.35	27—Hudson.....	Vail	15:32.25	32:06.90	51:14.10	1:08:22.90	1:25:38.50	1:43:09.95	2:02:08.90	2:19:39.45
79.45	41—Frontenac.....	G. Chevrolet.....	16:49.90	31:05.30	49:20.30	1:05:51.15	1:24:01.80	1:40:38.30	1:57:08.00	2:17:08.30
78.75	31—Ballot.....	Thomas	14:56.75	30:55.30	47:16.95	1:05:09.50	1:21:29.90	1:38:45.20	2:05:39.95	2:23:20.15
78.60	8—Stutz.....	Cooper	14:57.65	31:00.90	47:41.90	1:04:29.90	1:21:20.50	1:30:16.75	1:55:09.85	2:11:42.15
	1—Chevrolet.....	Durant	20:00.40	36:10.25	01:19.90	1:17:58.00	1:35:03.35	Lap 55—out, broken steering		
	2—Frontenac.....	Mulford	15:12.00	32:41.90	49:32.90	Lap 37—out, broken driveshaft				
	5—Richards.....	Brown	15:27.80	Lap 15—out, broken connecting rod						
	9—Duesenberg.....	Milton	15:28.10	31:37.30	48:31.55	1:04:52.15	1:25:18.85	Lap 49—out, broken connect		
	10—Duesenberg.....	O'Donnell	15:27.20	32:01.85	48:57.90	1:05:41.85	1:22:59.90	1:40:27.70	Out, broken piston	
	12—Roamer.....	Hitke	15:34.35	32:05.40	49:21.50	1:06:15.75	1:26:38.75	Lap 57—out, broken bearing		
	15—Roamer.....	LeCocq	15:31.00	32:02.00	48:59.85	1:05:37.95	1:23:13.90	1:40:24.90	1:57:10.10	2:13:24.10
	17—Hudson.....	Haibe	19:59.70	41:38.65	59:40.90	1:16:53.10	1:40:15.70	1:58:42.00	2:16:26.00	2:35:48.10
	18—Thurman.....	Thurman	15:44.40	30:30.00	52:59.10	1:09:45.30	Out, turned over			
	19—Detroit.....	Kirkpatrick	16:01.70	39:58.85	08:01.80	1:29:37.65	1:49:12.35	2:16:06.00	2:48:55.50	Lap 70—
	21—Stickel.....	Hickey	16:13.45	35:19.35	53:16.60	1:11:22.75	1:28:16.25	1:46:36.90	2:04:07.15	2:21:58.10
	22—Duesenberg.....	D'Alene	15:18.45	30:21.20	47:38.20	1:04:43.90	1:22:10.20	1:39:41.25	2:02:03.90	2:17:34.45
	23—Shannon.....	Shannon	17:09.80	35:45.35	54:05.80	1:12:12.40	1:32:05.40	1:50:03.55	2:07:36.90	2:28:16.15
	28—Oldfield.....	Sarles	Lap 9—out, broken rocker arm							
	29—Peugeot.....	Klein	15:21.20	33:49.90	51:27.35	1:08:45.85	1:26:05.95	1:43:27.85	2:19:18.45	Lap 71—
	33—Ballot.....	Bablot	15:29.50	31:24.15	47:17.95	1:05:03.75	1:25:18.30	1:42:24.45	Lap 63—out	
	34—Ballot.....	Wagner	14:59.90	31:00.40	49:29.25	1:06:02.90	Lap 45—out, broken wheel			
	36—McCoy.....	McCoy	20:26.25	39:41.25	59:04.85	Lap 37—out, oil line broken				
	37—Baby Peugeot.....	Boillot	16:47.15	33:45.85	49:28.50	1:07:05.90	1:24:45.35	1:42:26.00	2:00:01.15	2:17:11.15
	39—Frontenac.....	Boyer	15:09.80	29:34.30	46:08.90	Lap 30—out, threw wheel and broke axle				
	43—Toft.....	Toft	16:46.10	34:35.50	52:53.75	1:11:36.90	Lap 45—out			
	48—Peugeot.....	Howard	16:04.20	33:01.35	50:26.70	1:07:58.10	1:25:55.50	1:44:43.80	2:17:25.55	2:44:55.15



The three numbers hung from the swinging arm on top of the pressstand are for the drivers' benefit. Every lap they tell who is running first, second and third. The Hoosier oval is the only one so fitted

tively easy matter to twist off the axle ends. In the latter part of the race Chevrolet broke the steering knuckle on the right side and cleverly brought his cars to the pits. Inspection of the broken member seemed to indicate the metal had become crystalized, resulting in breakage. Before the race Chevrolet had fitted new knuckles, which appeared to be anything but the chrome-vanadium kind necessary for

fast work. Louis, however, brought out an old knuckle and fitted it and a new tie-bar, which had been damaged when the car was driven in with the wheel gone.

During the brake tests in the morning Boyer in the Frontenac applied his brake unintentionally and broke out a portion of the aluminum brake shoe carrier. This may have been the beginning of his undoing, for he was forced out

of the race early when the left rear wheel came off and wrecked the axle member on that side. The other Frontenac driven by Mulford was put in the also-ran brigade by breaking its drive-shaft.

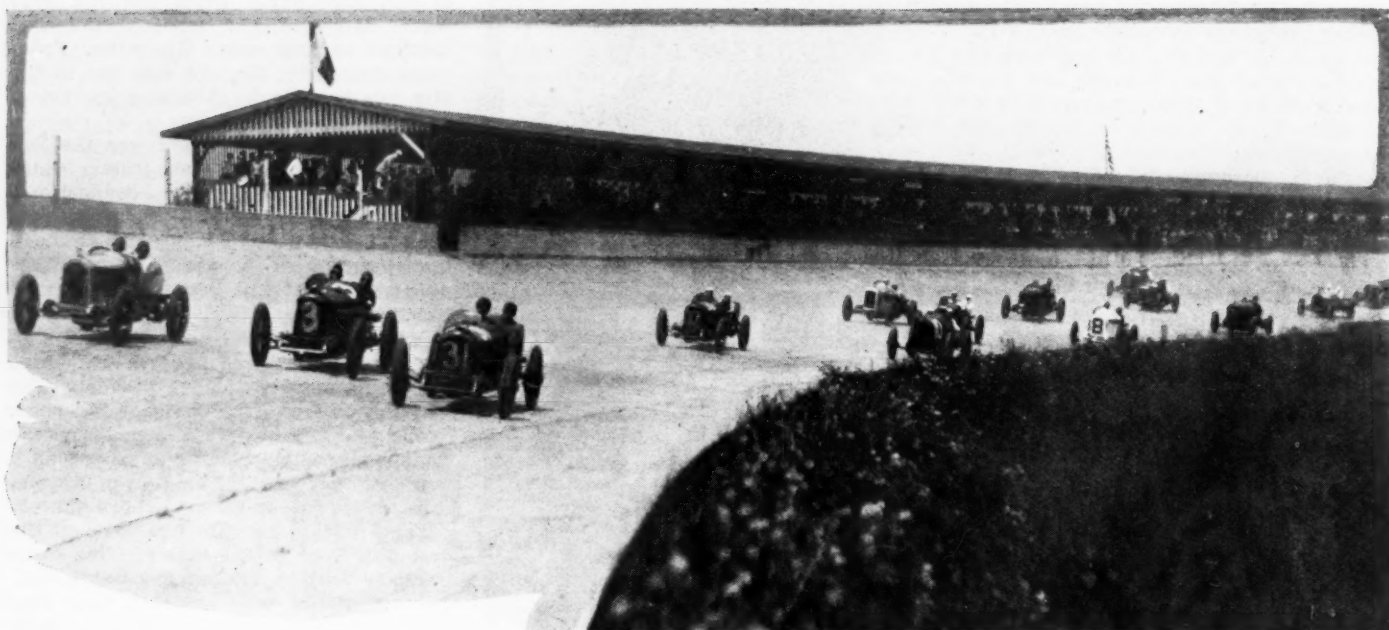
The first car to come in was the Durant Special, which was losing water from the radiator hose connections. Water was taken on and the stop consumed nearly 5 min. Then came Haibe in the Hudson, which was suffering from plug trouble. At this point with the race hardly on Roscoe Sarles in the Oldfield Special came in, and an examination of the trouble showed a broken valve rocker arm, which forced him out. He was the first to leave the race for good.

The first tire change was made on the Shannon Special, which had to put on a new left rear shoe. The Detroit Special then rolled in and lingered 5 min., to change plugs. All this was done in the first half hour of the race. Haibe came in soon with spark plug trouble, followed by Goux, who needed a right rear tire. The pit work here was a little clumsy, and it was common to see mechanics drop hammers and jacks in the anxiety to get quick action. A Johnny Aitken was needed to get the necessary rapidity of action without making a fuss about it, as was the custom of the famous Johnny.

No. 18 car, driven by Thurman came to the pits for water and changed plugs. This was Thurman's only stop before his fatal accident. Durant came in again to lash his hose connections in place, and right on his heels came Goux, who was forced to change a left front tire. Wilcox, who had been driving at a terrific pace up to this time, was noted

Laps at Indianapolis 500-Mile 1919 Race

	Lap 90	Lap 100	Lap 110	Lap 120	Lap 130	Lap 140	Lap 150	Lap 160	Lap 170	Lap 180	Lap 190	Lap 200	No.
Lap 80	2:26:10.50	2:42:08.75	2:58:57.20	3:18:45.50	3:35:27.75	3:51:56.90	4:08:27.55	4:25:31.16	4:42:57.15	5:05:02.40	5:22:35.65	5:40:42.87	3
14:24.00	2:31:27.00	2:48:16.10	3:05:34.60	3:25:09.95	3:42:12.85	3:59:12.55	4:16:23.50	4:33:28.95	4:50:31.00	5:08:03.20	5:26:20.10	5:44:29.04	14
18:50.00	2:35:53.35	2:53:08.20	3:12:58.30	3:30:05.45	3:47:41.10	4:04:56.90	4:22:01.75	4:40:22.35	4:57:26.30	5:14:36.93	5:31:42.40	5:49:06.18	6
18:51.00	2:37:31.80	2:54:48.35	3:12:35.90	3:34:52.90	3:52:20.85	4:09:47.65	4:26:55.35	4:45:58.28	5:03:03.35	5:20:10.93	5:38:38.55	5:55:16.27	32
21:58.00	2:38:59.50	2:56:45.00	3:14:23.15	3:31:55.85	3:49:26.90	4:06:38.20	4:26:02.65	4:43:32.75	5:09:31.85	5:27:47.70	5:46:12.85	6:05:03.92	26
08:31.00	2:24:15.90	2:40:18.40	3:15:26.40	3:31:56.85	3:46:44.80	4:03:07.80	4:19:38.25	5:04:04.90	5:20:42.70	5:37:27.90	5:53:58.30	6:10:10.92	4
09:16.00	2:28:48.50	2:45:27.75	3:27:11.30	3:46:03.00	4:06:07.10	4:23:58.50	4:43:04.85	5:01:50.30	5:19:03.20	5:37:37.90	5:53:58.75	6:10:10.64	7
19:39.00	2:37:04.25	2:56:57.70	3:15:44.80	3:34:35.90	3:53:30.90	4:12:18.10	4:34:29.35	4:53:56.30	5:13:28.00	5:33:19.35	5:53:42.90	6:12:42.00	27
17:08.00	2:33:32.30	2:49:52.50	3:06:41.90	3:23:25.45	3:39:53.70	3:57:13.10	4:25:47.35	4:42:09.30	5:09:38.25	5:43:36.95	6:00:20.90	6:17:21.79	41
23:20.00	2:41:07.00	3:07:33.20	3:25:43.90	3:44:25.60	4:03:39.60	4:28:42.55	4:47:03.55	5:05:19.90	5:23:58.35	5:42:30.30	6:00:48.00	6:21:10.92	31
11:42.00	2:28:24.45	2:47:29.95	3:05:35.45	3:23:36.35	3:55:43.95	4:13:45.65	4:34:15.15	4:59:56.30	5:20:36.35	5:42:10.15	6:02:58.60	6:21:35.05	8
steering gear													1
													2
													5
connect on piston bearings													9
													10
													12
													15
													17
													18
													19
Lap 70	2:40:19.40	2:59:28.90	3:23:55.45	3:43:27.75	4:02:48.45	4:21:24.35	4:41:40.00	5:00:21.25	5:18:52.65	5:37:46.55	5:56:01.60		21
2:21:58.00	2:34:54.70	2:53:10.50	3:12:28.65	3:33:22.90	Out, broken axle								22
2:17:34.00	2:46:47.30	3:06:25.60	3:26:24.80	3:48:48.60	4:08:05.25	4:27:12.20	4:48:08.25	5:02:43.35	5:31:12.90	5:50:35.80	6:12:14.65	6:30:50.75	23
2:28:16.00													28
Lap 70													29
oil line broken, valve stuck													33
													34
													36
2:17:11.00	2:34:25.00	2:51:26.50	3:09:03.85	3:26:24.80	3:43:57.40	4:04:17.95	4:22:09.25	4:40:03.60	5:00:54.15	5:18:24.40	5:35:54.75		37
													39
													43
2:44:55.00	3:09:19.50	3:32:47.90	3:53:50.85	4:21:07.75	5:18:28.85								48



This picture shows the southwest turn of the track with the cars pretty well bunched. The turn was dreaded by the drivers because of the bad hump in it. To avoid it many of the drivers drove very high on the bank

coming into the pits and had to fit a new right front tire. This was one of the fast changes made, being done in 19 sec. by the pitmen. It was not long after this that Joe Boyer was forced out with the broken rear wheel and axle. Haibe stopped 24 sec. at the pits for a right rear tire, and the Detroit Special drove up as Haibe was getting out. The former's engine was suffering from valve trouble, some of the sticking, particularly the exhaust valves.

At about 12 o'clock Rene Thomas made his first stop for a right rear and front tire. After him came Bablot in the Ballot for an adjustment on the magneto holding-down mechanism. The terrific pace set by de Palma evidently was telling on the Ballot cars, as trouble like that befalling Bablot was hardly expected from the much-touted French speed creations.

Mulford Breaks Driveshaft

Ralph Mulford drew up just the other side of the pits, where his car refused to answer to the coaxing of the driver. Mulford's trouble was a broken driveshaft. The Detroit Special was making regular stops at the pits now for water. This indicated that there was something wrong, perhaps with the oiling system, or the pistons inclining to freeze up some. The McCoy Special drew up after the Detroit Special, and when the bonnet was lifted, the engine was hardly visible from the great amount of oil leaking from the joints. The car finally was forced out.

The next cars to slow down at the pits for various reasons were Haibe's Hudson, which needed a left front tire, Tommy Milton's Duesenberg, which was not firing right from distributor trouble. The next car to pull up was the Roamer, with Hitke up, for fuel. LeCocq, also in a Roamer, drove up for a right rear tire, followed by Eddie Hearne, who changed both right rear and front tires. At this

point Toft's car was forced out of the running with a broken connecting rod. Right after this Eddie O'Donnell came to grief in his Duesenberg, which also broke a connecting rod. True to its habit the Haibe-Hudson combination was stopping periodically for water.

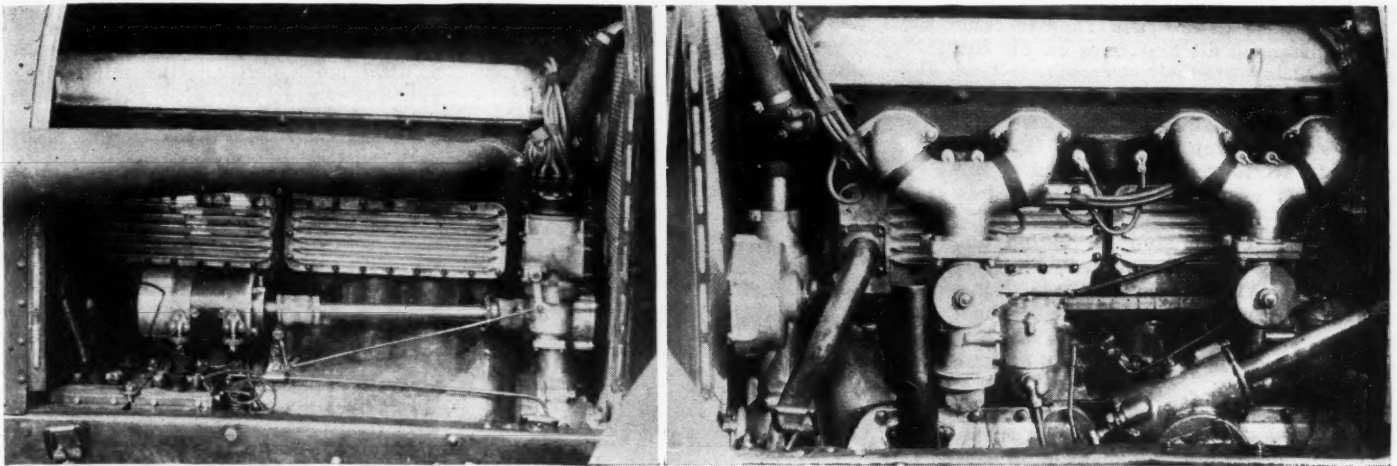
Chevrolet stopped for a left rear tire and right after him de Palma came in for his first stop to replace a right rear and front tire and take on gasoline and water. He stopped for about 1½ min. Hardly had he gotten away when Haibe came in again for his usual quota of

water, but he surprised the spectators this time by also taking on oil and gasoline, besides changing the right rear and front tires. Bablot also drove up for a tire change and took on fuel. The Durant Special stopped for a relief driver and tightened a loose steering member. Rene Thomas made his second stop for oil, a left rear tire and general inspection of his mount. Thomas took things very easy and apparently was in no great haste to get under way, quite in contrast to the excitable Goux.

Hardly had the pitmen seen Thomas



Vast crowd in the infield. Long before the start the infield and parking spaces filled up with cars. Most of the Indianapolis business houses closed early in the day so employees could get to the race



Right and left sides of the new Duesenberg eight-cylinder engine used in Milton's car, which was forced out by a broken rod. This is fitted with two carburetors and Delco ignition. Like the Ballot engines the eight cylinders are in line and have a crankshaft with the throws at 90 deg.

get away when the Detroit Special rolled in for a drink of water and Howard in the Peugeot spent over 5 min. at the pits for gasoline, oil, water and two tire changes.

Rene Thomas had a little difficulty

with one of his oil leads and was forced to stop for 3 min. at the pits to tighten the lead going to the oil gage on the dash. Bablot's car came in for gasoline, water and a right rear tire. O'Donnell drove the No. 10 Duesenberg

into his pits to try to loosen a stuck valve. Eddie got down and listened on the air intake of the carburetor while his mechanic cranked the engine and detected an intake valve that was not seating. Fred Duesenberg, who was in the pit, advised dismantling the job, and further examination showed a broken connecting rod, so the car had to be relegated to the garages back of the pits.

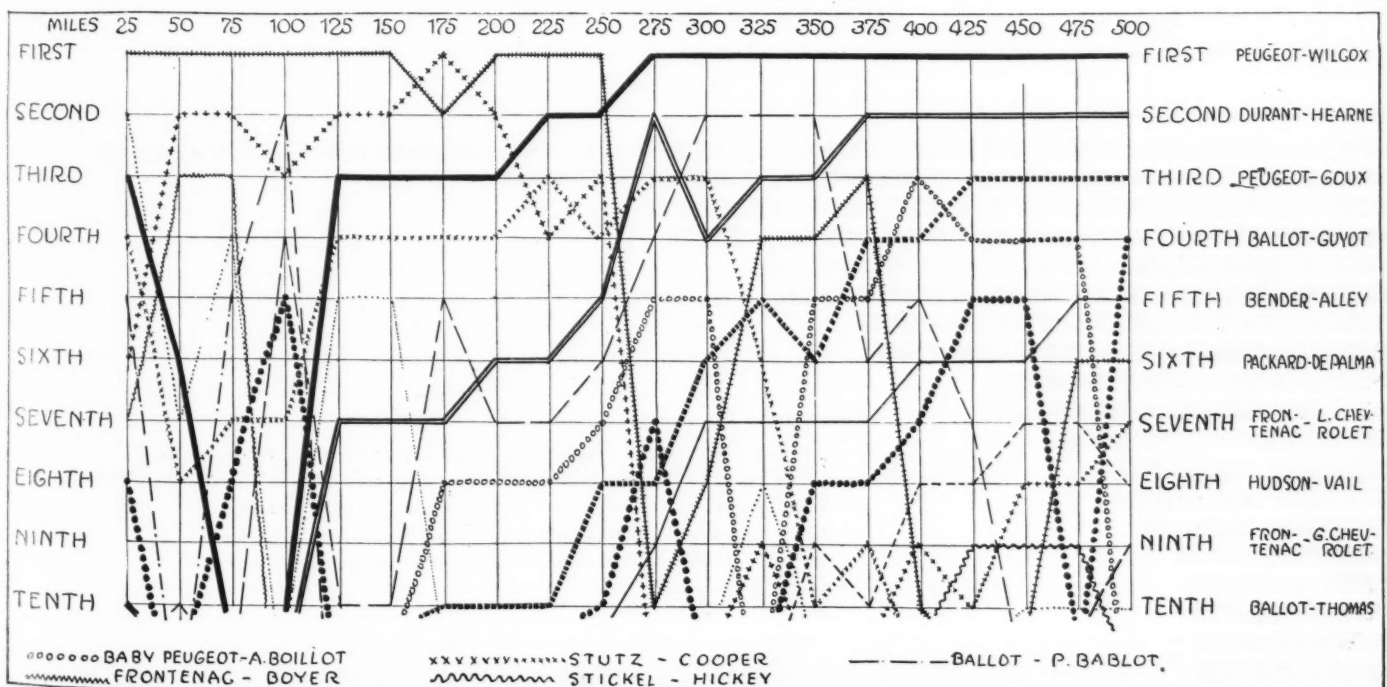
Howard appeared regularly with his Peugeot at the pits but was not able to overcome the difficulty previously mentioned. Art Klein drove his Peugeot in, owing to the fact that the exhaust pipe support on the rear had broken loose from the frame, necessitating an emergency repair. At 1:30 the Shannon Special stopped for gasoline, and the driver took advantage of the delay to tighten the shock absorbers. In fact, it was quite common to see drivers and

Equipment of Winners in Indianapolis Race

CAR AND DRIVER	IGNITION	CARBURETER	SPARK PLUGS	OIL
Peugeot, Wilcox.....	Bosch.....	Miller.....	Oleo.....	Oilzum
Durant, Hearne.....	Bosch.....	Miller.....	A-C.....	Harris
Peugeot, Goux.....	Bosch.....	Zenith.....	Oleo.....	Castor
Ballot, Guyot.....	Bosch.....	Claudel.....	Doublel.....	Castor
Bender, Alley.....	Bosch.....	Miller.....	Bosch.....	Aristo
Packard, de Palma.....	Delco.....	Zenith.....	A-C.....	Monogram
Frontenac, L. Chevrolet..	Bosch.....	Miller.....	Rajah.....	Oilzum
Hudson, Vail.....	Delco.....	Hudson.....	A-C.....	Oilzum
Frontenac, G. Chevrolet..	Bosch.....	Miller.....	Rajah.....	Oilzum
Ballot, Thomas.....	Ballot.....	Claudel.....	Doublel.....	Castor

All these used Goodyear cord tires, except Alley, who used Mason tires. All used Rudge-Whitworth wheels and Hartford shock absorbers

How Positions Shifted in the 500-Mile Race



mechanics tighten their shock absorbers.

At one time in the race Thomas came in and changed all four tires on his car, filled the gasoline and oil tanks and replaced all the spark plugs. While he was getting away, de Palma came in for a very long stop, at which time he changed all four tires, replaced a few plugs, took on water and put in a new exhaust valve on No. 1 left cylinder. This was a very costly stop for Ralph and gave Howdy Wilcox a chance to get way in the lead. At this time de Palma remarked that the right front wheel bearing was loose and perhaps broken, but he continued to drive at the same clip as before.

Vail, who had been running very consistently, came in for water and gasoline. The Detroit Special dropped out at this point with a leak in the waterjackets. Chevrolet surprised the spectators by coming in minus his right rear wheel, but managed to get going again after considerable work had been done at the pits. D'Alene, who made but two stops in the race, came for a left front and right rear tire, gasoline and oil and changed plugs.

Wilcox Loads Up

Goux made a hasty stop in his pits for gasoline and oil, when great excitement prevailed upon the arrival to the Wilcox right after Goux. Howdy, who had planned his race just so, sought this moment to change all his tires and load up with fuel and oil. Hickey had not up to this time made a stop, but finally was forced to do so from the fact that the tail on his machine became loose. He also loaded up with water, gasoline and oil. He stopped again a few minutes after this to inspect the body and tail once more. It was noted after this that the mechanic on this car was forced to hold down the tail with his arm as much as possible.

Guyot rolled his Ballot up for a complete tire change and also took on gasoline. Taking on fuel was crudely executed in some cases, most of the fuel going on the brick track instead of into the tanks. Hasty pitwork, of course, is



Many did not know that Wilcox drove his car a long ways with a broken frame horn. He lashed it in place at the pits

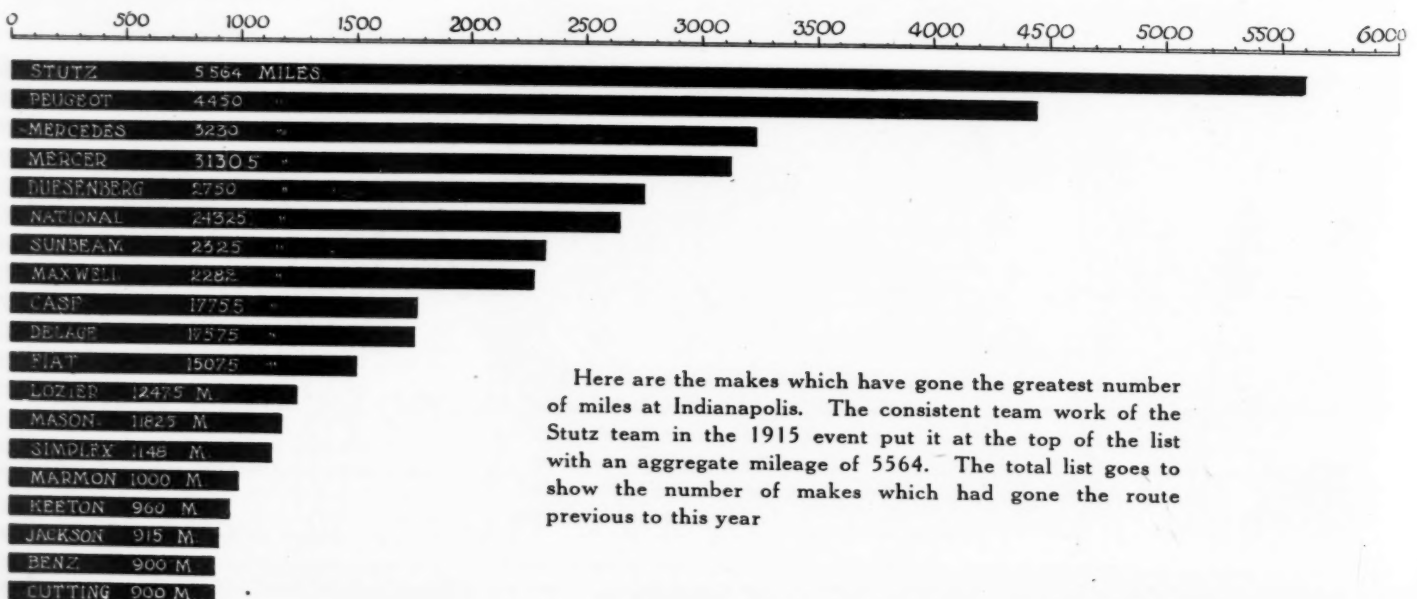
essential to win a race, but there were many instances of where the gasoline could have been poured into the tanks a little more deftly. One milk can of gasoline poured carefully will save more time than two cans where only half of each can is emptied where it is intended to go.

Eddie Hearne, following the example of Wilcox a few minutes before, took the precaution to change all his tires, fill up with oil, water and gasoline and tighten his shock absorbers. Rene Thomas made another stop to change all tires, take on supplies and went out to lessen the breach between himself and the leaders. He made only one stop after this, and that was for a right rear tire.

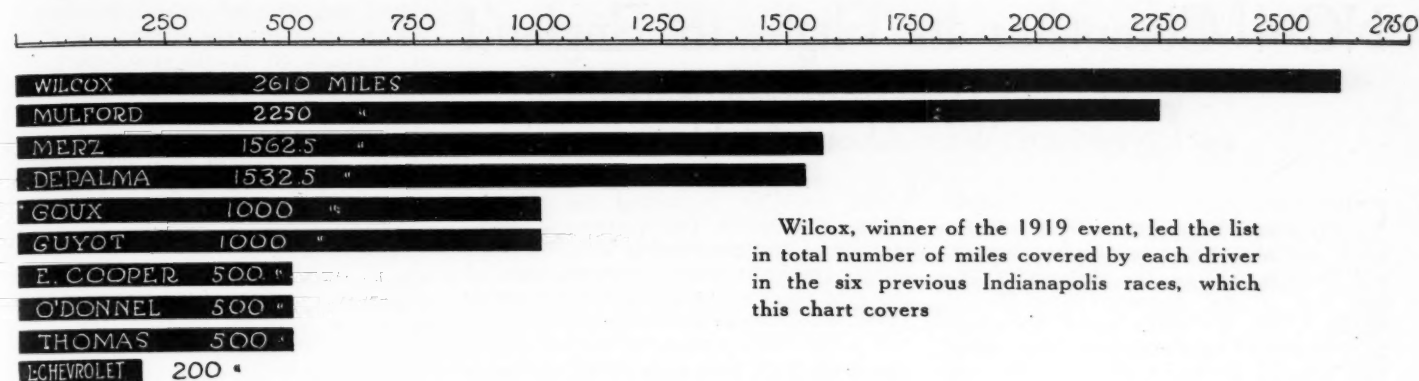
De Palma's last stop was also a costly one and allowed not only Wilcox, but a half dozen others, to steadily gain on him. His trouble this time was replacement of the right front wheel bearing,



Mulford had to push his car in, and the trouble was found to be a broken driveshaft



Here are the makes which have gone the greatest number of miles at Indianapolis. The consistent team work of the Stutz team in the 1915 event put it at the top of the list with an aggregate mileage of 5564. The total list goes to show the number of makes which had gone the route previous to this year



Wilcox, winner of the 1919 event, led the list in total number of miles covered by each driver in the six previous Indianapolis races, which this chart covers

which was completely smashed. After this repair was made the big Packard rolled around the oval in its usual convincing way.

Cooper, who had been looked upon as a dangerous contender ran steady for a long time, but valve trouble eventually overtook him and finally Earl turned the wheel over to his mechanic and went into the pits. But the Stutz ran for a considerable distance with the usual popping, a token of a valve that refuses to seat.

Gaston Chevrolet had to make a stop in the Frontenac to straighten out a bent tie-rod, as his wheels were not tracking properly. Toward the end of

the race a good many of the drivers sought relief and turned the wheel over to other members of their teams. Altogether there was considerable breaking up of men and machinery, all of which seems to indicate that the day is not far away when we must agitate smaller piston displacement. The cars are getting too fast.

TACOMA PLANS BIG JULY 4 RACE

Tacoma, Wash., May 30—Eddie Rickenbacker is to serve as referee at the Tacoma speedway races July 4 also. The card calls for Resta, Chevrolet, Durant, Mulford and Hearne. Chevrolet and

Resta will make the long jump from New York direct to Tacoma for the event, sending their cars on the long 3000-mile journey by fast express. Prospects are for the biggest and best race of the seven years of the Tacoma speedway.

GOOD FIELD IN INTER-CITY RUN

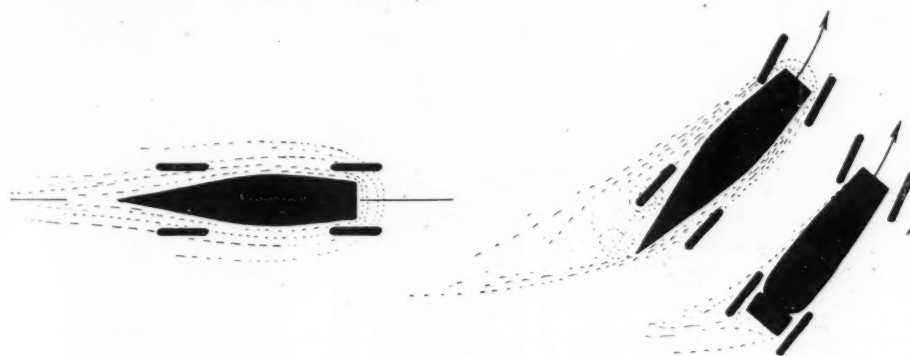
Chicago, June 3—Possibilities of twenty-five or thirty cars in the inter-city reliability run are indicated by the announcement that there will be at least sixteen cars representing Chicago. These will be made of the Chicago Athletic Association and Chicago Automobile Club cars, which will compete with the New York Athletic Club, June 12-13, for the trophy donated by Capt. E. V. Rickenbacker.

The run is a two-day event from New York to Greenfield, Mass., and return. Most of the Chicago cars will be driven over the road to New York by their owners. Richard Kennerdell, chairman Contest Board American Automobile association, will referee the match and Fred J. Wagner will be starter.

BROWNE HEADS OAKLAND BRANCH

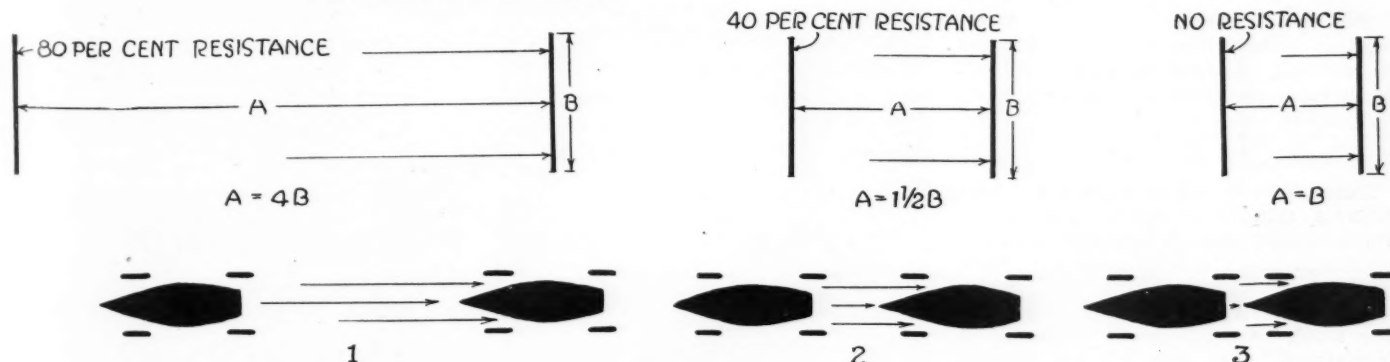
New York, May 31—Chas. M. Browne, for the last ten or eleven years manager of the New York Winton branch, has resigned. June 1 he becomes manager in New York for Oakland, which will convert its dealership into a branch.

The Oakland business, which has been handled by the Sidney A. Bowman Co. since 1913, will be moved to the C. T. silver building.



No doubt many people who saw the race wondered why the Ballot cars had no tails like the other cars. On a track like Indianapolis a tail does very little good, except to steady the car a little on the turns. A long tail on a race car is a valuable asset in a long straightaway, where the eddying currents have time to collect behind the car, but where turns must be negotiated the eddies are broken and the car is just as well off with a tank on the rear, as the Ballots were built.

This is shown in the diagram



This diagram shows how a comparatively slow race car can take advantage of the laws of wind resistance by following in the path of a faster car. If two disks of equal diameter are placed, one back of the other, the rear disk is affected by the air current in proportion to its position. Thus, if they are placed as in position 1 the rear car gets 80 per cent of the wind resistance of the first car. If the disks are right behind each other for a distance equal to their diameters, the second disk gets no wind pressure at all. In the same way, if a race car can get right behind a fast car, the latter will drag it along and often adds very materially to the speed of the trailing car

NC-4 Completes Its Flight to England

Actual Flying Time from New York to Plymouth Was About 57 Hours

CHICAGO, June 2—The NC-4 reached Plymouth, England, Saturday afternoon and thereby ended its epoch-making journey across the Atlantic. The last leg of the journey, from Ferrol, Spain, where the plane spent the night, to Plymouth, approximately 500 miles, was covered in less than 7 hr. The actual flying time of the NC-4 from New York to Plymouth was about 57 hr., or two days and 9 hr. The fastest previous crossing of the Atlantic on record is that of the Cunard vessel "Mauretania," which made the trip from Liverpool to New York in four days, 14 hr. 27 min. Here is the time table of the NC-4:

Rockaway to Chatham.....	8:58
Chatham to Halifax.....	3:51
Halifax to Trepassey.....	5:45
Trepassey to Horta.....	15:13
Horta to Ponta Delgada.....	1:44
Ponta Delgada to Lisbon.....	1:44
Lisbon to Mondego River.....	1:30
Mondego to Ferrol.....	3:07
Ferrol to Plymouth.....	6:59

EXPRESS SERVICE BY AIRPLANE

Chicago, June 2—Beginning tomorrow, two Curtiss airplanes will deliver shipment to dealers in the territory adjacent to Chicago. The service has been established by Alfred Decker & Cohn, makers of Society Brand clothes, and is to operate on a regular flight schedule, Tuesday, Thursday and Friday of each week. Fitting ceremonies will mark the inauguration of the express. Harry H. Merrick, president of the Chicago Association of Commerce, is slated to christen the two planes tomorrow on the company's field, which extends over 40 acres and already is equipped with hangers. Lieut. David L. Behocke, lately of Chanute field, is pilot. The planes will have checkerboard planes, so they can be distinguished at a great height.

PHILADELPHIA SALES SLOWER

Philadelphia, Pa., May 31—While sales slowed up a bit during this week of warm weather, most of the car dealers report an increase in inquiries and dates between their salesmen and customers on prospective sales, over the previous period of six days, especially with regard to closed cars.

Truck dealers and distributors report business still very quiet. Indications are, however, that when the highway legislation is all straightened out, there will be a big impetus in buying, as undoubtedly many, owing to uncertainty over truck restrictions as suggested at Harrisburg, are holding off buying trucks.

Within the next few days Governor Sproul is expected to sign the Dithrich motor vehicle bill, which has just passed the senate. This measure provides for many changes in the licensing, registration fees and general regulations of

motor vehicles, replacing the law of 1913. The Motor Truck Owners' Association of Philadelphia is credited with having brought about modifications of some of the sweeping restrictions originally appearing in this bill.

TIME OF TAX PAYMENTS EXTENDED

Washington, May 29—An extension of time has been allowed to car and parts manufacturers and operators of truck freight or express routes for filing return of taxes due under the Revenue Act for the periods from Feb. 25 to March 31 and from April 1 to April 30, 1919, until June 15, 1919. The extension has been granted because of an unavoidable delay in the printing and distribution of the necessary blank forms for making the returns.

The specific sections of the act referred to are No. 900, which is on the manufacturer's selling price of trucks, cars, motorcycles and accessories and

parts, and No. 500, which imposes the tax on transportation of goods by freight or express on trucks competing with rail or water.

Delay also has been granted for the filing of returns on admissions to shows for the same reason and until June 15.

CLOSED CAR SHOW FOR DETROIT

Detroit, May 30—The Detroit Automobile Dealers' Association is making arrangements to stage its first closed car show. It will be held at the Arena, Oct. 6-11. Plans for the event are being drafted under the supervision of Secretary H. H. Shuart, who so successfully put on Detroit's big show this spring.

The success of the 1919 show, coupled with the inability of the association to give closed car models proper display, owing to limited floor space, has caused the association to arrange for a separate event. The closed car is essentially a cold weather product and it was forced into the background this spring by the necessity of the dealers to exhibit their open car summer models.

This fall, however, when winter is beginning to tinge the air, the dealers believe is the right time to merchandise the closed car. It is the aim of the association to make the event an annual one



That this motor car dealer has gone into the retail airplane business to stay is evident from the two views above. Planes now share showroom space with cars on Chicago's row and sales already have been made

and practically every dealer and distributor has signified his intention of reserving show space.

Mr. Shuart assumed management of the association a few weeks ago. A new division, consisting of truck dealers and distributors, has been organized, and a preliminary meeting was held May 27. The association believes that a truck division is essential, inasmuch as the truck dealers have so many matters which are not in common with the car dealers, and the new division provides them with independent facilities to handle the truck interests.

The first used car report of the association was issued May 15. With the aid of this report the association hopes to assist dealers in getting a more accurate gauge on the used car prices and kindred matters. It is now proposed to issue a used truck report, the first of which will appear early in June.

The Smith-Glines Sales Co., distributor of the Hupmobile, is the latest company to join the association, which now has a membership of thirty-three firms.

GRAND RAPIDS SOLVES SUNDAY GARAGE PROBLEM

Grand Rapids, Mich., May 29—Every garage in the city but two will be closed tight on Sundays hereafter. This decision was made by the Automobile Business Association this week. The two exceptions are the Hermitage Garage & Auto Co. and Glenn R. Austin. The association designated these two places to handle the Sunday trade. It has developed that there never was enough work to warrant any one garage bearing the overhead expense of keeping open on Sunday when all others are doing business.

MOTOR CULTIVATOR TRIALS ARE POSTPONED

Decatur, Ill., June 2—The motor cultivator trials, which were to have been staged here Wednesday and Thursday of this week, have been postponed to June 12-13. As a matter of fact, there has been so much late rain in this section, as elsewhere, the corn is not up high enough for cultivating. With the good weather of last week continued, much progress is expected now.

TRADE TO MARK HIGHWAYS

Des Moines, Iowa, May 31—The Motor Trades Bureau of the Des Moines Chamber of Commerce will spend about \$2,000 marking the highways which enter Des Moines during the present season. This week, Polk county directors for the eight highway associations which enter Des Moines met. An unusual amount of interest in these associations is being manifested this season. Polk county is proposing to vote \$2,000,000 for hard-surfaced roads, and enough signatures have been secured to call a special election to vote on the bonds in accordance with the law passed by the recent Iowa legislature.

French Dealers Want U. S. Motors

Government Is to Decide Whether American Cars and Trucks Shall Stay

By W. F. Bradley

ARIS, May 10—An official decision regarding the disposal of the American army trucks and cars now in France is expected within a few days. At the end of December, 1918, the Army possessed 7575 cars and 32,500 trucks. Only a very small number of these are required for the army of occupation, and the rest must be disposed of in Europe or brought back to America. This week the liquidation board prepared a detailed statement of motor vehicle material no longer required by the army and submitted the same to the French government, who alone has authority to say whether the material shall remain in France or not.

It is hoped that the French reply will be received early, so this matter may be cleared up and the men allowed to return home. The situation is rather peculiar. French car manufacturers are bitterly opposed to any American army cars being allowed to remain in France and are bringing the greatest possible pressure to bear on the government to secure their shipment back to America. They maintain that if it is absolutely necessary to sell these vehicles in France, the purchasers should be called upon to pay the 70 per cent import duty now in vogue, not on their present value, but on the original value of the cars and trucks.

Dealers and users, on the other hand, are scrambling over one another in their endeavors to get this army material. One of the officers of the liquidation board said, "Buyers are literally shaking good money in our faces in order to get delivery of these automobiles." The offers are coming from all quarters and from men with the best financial backing, who want to buy in big quantities. No offers can be accepted, however, until the French decision has been rendered as to the conditions under which the material shall be disposed of.

No Fords for Sale

It is stated that the Army has neither Dodges nor Fords for sale, all those now in hand being required for the army of occupation. The only other car of which large numbers exist in France is the Cadillac; but while this has an excellent reputation, it is too powerful a car and has too high a gas consumption to suit the average French purchaser of used cars.

A certain quantity of the American army material already has been sold to allies other than France who are in urgent need of motors. Thus, a certain number of trucks have gone to Rumania, Serbia and Belgium. In addition the reconstruction department of the French government has taken some

American army trucks. When these purchases have been made the motor vehicle officers of the liquidation board have insisted on sufficient spare parts being taken to keep the vehicles in efficient service for at least six months. This has been done in an unofficial manner to protect the interests of the American manufacturer. Nothing could be more disastrous to the reputation of the American industry than to allow numbers of trucks to go to foreign countries without any means of maintenance.

In addition to the vehicles, there are large service depots and repairshops to be disposed of. The most important of these is the reconstruction park at Verneuil. This place has very big machine shops and immense stocks of spares, including 146,000 solid tires. Owing to the shortage of buildings, these tires had to spend a winter outdoors without protection and have suffered a little in consequence. Probably they will be sold with the trucks, for they are inch sizes and could not be used on European vehicles. Numerous rumors have been afloat regarding the disposal of the Verneuil shops.

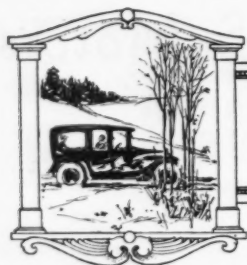
WILLS AND LEE TO BUILD PLANT FOR NEW CAR

Detroit, May 31—C. Harold Wills and John R. Lee, who several months ago left the Ford Motor Co., and their associates have taken an option on 2000 acres on the St. Clair river between St. Clair and Port Huron, 50 miles north of here, where they will build a plant to employ, eventually, 35,000. The plant will be for the six-cylinder car Mr. Wills has designed.

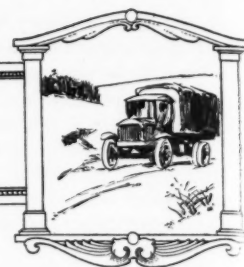
EXPECT WRIGHT-MARTIN MERGER

New York, June 2—Negotiations pointing to an early merger of the International Motor Co. and the Wright-Martin Aircraft Corp., is indicated by negotiations which have been in progress for some time. It is expected that next week the stockholders of Wright-Martin will approve of a plan whereby the New Brunswick factory of Wright-Martin is sold to the International Motor Co. in exchange for stock in the latter organization. The factory will be used as increased capacity for the manufacture of trucks and should permit of the International doubling its truck output. The New Brunswick factory has 500,000 sq. ft. area and has been used for the manufacture of Hispano-Suiza engines during the war.

Wright-Martin will be reduced in capitalization and continue to exist as an aircraft corporation for the carrying on of necessary aircraft development and manufacturing work.



EDITORIAL



3-Liter Races Worth While

PROBABILITIES that races of 1920 will be largely limited to cars of little more than half the displacement of those at present will be greeted with much satisfaction by the industry as a whole and by motor car dealers in particular. Most cars now on the market have a displacement considerably less than the 300-cu. in. limit of present-day races. The 3-liter cars, which it may be assumed may make up the greater proportion of next season's new speed developments, are in size not far from many of the vehicles on the open market which dealers are handling. There should be more talking points for dealers as a result of small-car races.

CONSIDERATIONS of economy in the first cost and operating expenses make quite advisable a higher development of the cars of smaller displacement. Carl Fisher, who is credited with sponsoring the 3-liter size for next year may, of course, not be wholly unaffected in his decision by the fact that such a limit for Indianapolis next year would bring a larger entry from Europe by adding the new cars being built for the French Grand Prix. But the effect on American car development certainly will be good, because the 300-in. cars have had their innings for several years and racers of that size can be relegated to their stables along with the old 500-in. and 600-in. racers of the past.

Service Associations Needed

SERVICE managers' associations are being revived after an enforced period of inactivity. These associations have accomplished good work in their local fields. While service conditions are more or less general throughout the country, we have no organized means of conveying the lessons learned by a certain locality to that of another. The absence of a national organization is a severe loss.

Tractor Beats the Horse

GREATER speed can be made, both theoretically and practically, in fitting the seedbed than in plowing. This is because the character of the implements is different and because in seedbed fitting there is no such limitation put on tractor speed as there is by the shape of the plow bottom in plowing. Thus a tractor which has a speed higher than the conventional plowing speed can use it to advantage in seedbed fitting and can do a much greater amount of work in a given time. A comparison will make this clear.

ATRACTOR with three 14-in. bottoms, at a speed of 2 m.p.h., will plow approximately $8\frac{1}{2}$ acres in a 10-hr. day. The same tractor, pulling a 10-ft. tandem disk, with the necessary supplementary equipment, will fit approximately 24 acres in a 10-hr. day at a speed of 2 m.p.h., and about 30 acres at a speed of $2\frac{1}{2}$ m.p.h. If the tractor can be speeded up to 3 m.p.h., as many of them can be, it will fit approximately 36 acres in a 10-hr. day.

Clean Repair Jobs Pay

MORE than fifty per cent of a service station's complaints on repair work can be eliminated if cars are delivered in a clean and orderly condition. A customer secures his first impression of a repair job by the external appearance of his car. This is a fact that all service managers should take into account. While a job may be perfect mechanically, if the car is dirty and the controls are covered with oil, it leaves the customer in a disgusted frame of mind and the good work of the repairshop is lost.

ACAR clean-up man on the service floor is a good investment. Let him clean up every car. Wipe off the cushions, controls, fenders, etc., in fact, give the car a good going over, so that it will have a presentable appearance. If you haven't a porter, try one and see how much smoother your service station will run. Some shops even go as far as washing every car before it is delivered to the customer and throw the expense involved into the service overhead.

NEARLY every owner likes to boast about his car. It is a trait of human nature. Good, clean repair jobs promote satisfaction among a concern's clientele. It is one of the simplest methods of increasing the scope of a service business. Make more owners boasters.

NEARLY every large center of motor car distribution or production has a local service organization which handles its immediate problems. However, it is blinded to the work of other institutions of similar character because there is no national clearing house. The need of such an institution is great. Eventually it will come. Service needs its assistance now. The sooner service gets it the better for all concerned.

ANOTHER significant and important fact about tractor fitting is that such a load as is given to the tractor above is considered to be ten or twelve-horse work. Manifestly, it would be impossible for the farmer to hitch so many horses to any combination of implements and handle them successfully. In consequence, if he relies upon horses he will be compelled to haul smaller machines and go over his fields from two to three times. The tractor does it all in one operation, thus saving time, labor and expense at a time when these are all important to the farmer.

THIS comparison with horse work is so much in favor of the tractor that it should provide the tractor dealer with a convincing and unanswerable argument in favor of tractor work.

THAT a farm can be conducted on a horseless basis is evident from the article in this issue.

3% on Truck Chassis

Treasury Department Reverses Ruling as Result of Protests by Industry

Tax on Sales to Makers Changed Also

WASHINGTON, June 2—Special Telegram—As a result of numerous protests from the National Automobile Chamber of Commerce and the National Automobile Dealers' Association and other bodies, the Treasury Department has issued new rulings relating to some of the excise taxes on cars, trucks and parts. The tax on tires, accessories and parts does not apply when sold to the manufacturer or producer of cars, trucks or motorcycles for the sole purpose of being used in their manufacture or for sale on them. In all successive sales, however, it will be necessary for the buyer to furnish a certificate showing that the parts or tires will be used as prescribed.

The ruling on chassis whereby all chassis were classed as cars and taxable at 5 per cent, has been changed, and any chassis with a super-structure that will allow its use as a truck without any substantial additions is regarded as a truck and taxable at 3 per cent. All other chassis, however, remain taxable at 5 per cent.

RACINE TO SHARE STOCK

Racine, Wis., May 30—A majority of the employees of the Racine Auto Tire Co. have become stockholders in the corporation and in addition are to have a voice in the management. The stock is a guaranteed preferred issue and will participate with common in earnings and carry the same voting power. A small percentage of surplus earnings is to apply on payments. From the time of subscription the worker draws dividends, and no interest is charged during the time of payment.

The new stock system of dividend distribution is in addition to the bonus system inaugurated three years ago. Under this system day employees receive an additional percentage of pay at the end of each two-week period. Night workers receive a double amount.

ALL-AMERICAN TRUCK PLANS GREAT EXPANSION

Chicago, June 3—The All-American Truck Co., now operating in the Ogren plant here, has purchased 34 acres of land in the city for approximately \$100,000 and will immediately begin construction of a factory which, with other plants to be built by the company, ultimately will cost \$1,500,000. The first unit, on which construction will begin at once, will cost \$200,000. A bond issue loan has been arranged with the Fort Dearborn Trust & Savings Bank in the amount of \$150,000 for seven years at 6

per cent. Link-Belt progressive equipment will be used for main assembly and gravity conveyors for sub-assembly.

During the last six months the company has jumped from 249th place on the list of truck manufacturers to tenth position, it is said, and expects to be in third or fourth position by 1920. Production at this time is ten a day, and the present factory is capable of about fifteen a day. When the first unit of the new plant is completed it will handle thirty a day and when all the contemplated improvements have been made on the new property, a production of 100 daily is expected.

RECEIVER FOR MAXIM MUNITIONS

New York, June 2—Special Telegram—The Maxim Munitions Corporation, which was formed in 1915 with \$10,000,000 capital to take over the inventions of Hudson Maxim and which in June, 1918, announced its intention of making and marketing a farm tractor as well as acting as domestic and export distributor for the trucks manufactured by the Dart Motor Truck Co., has been placed in the hands of a receiver. The courts have appointed H. H. Henry, for the last two months president of the company and prior to that vice-president and general manager. It is understood that the assets and liabilities of the company are about \$1,000,000 each, and it is stated that there appears an excellent possibility of the company being reorganized and continued. Until the creditors and stockholders meet, however, nothing definite can be stated with regard to future plans. An early meeting is scheduled and in the meantime the business temporarily will be discontinued.

CAMPAIGN TO REPEAL TAXES

St. Louis, Mo., May 31—A plan of campaign for dealers and their local associations to pursue in the fight for the repeal of all motor car excise taxes is outlined in a special "tax-repeal" bulletin, issued today by Harry G. Moock, business manager of the N. A. D. A. He advises:

Get your local associations together. Send resolutions, letters and telegrams to Washington to your senators and to your representatives, asking for the repeal of these taxes.

Send these resolutions as an association.

Each member of the association should send an individual protest to his Senator and his Congressman.

Each association should call upon every line of business allied with the motor car industry to send a similar protest.

Each man in the association should ask every other business man he knows to make a similar protest.

KNIGHT ENGINED TRUCKS

Chicago, June 2—The Highway Motors Co. has been incorporated to build American Knight-engined trucks in 3½ and 5-ton capacities. It has purchased the assets of the Motor Trucks, Ltd., Brantford, Ontario.

Big Time for Jobbers

Hot Springs to Be Record Meeting of Automotive Equipment Association

Fifty Companies Seek Membership in Organization

HOT SPRINGS, VA., June 2—Special Telegram—The present convention of the Automotive Equipment Association will be the biggest ever held since the organization was formed four years ago. Nearly 600 reservations were made at the Homestead, and the delegates have been arriving on every train for several days. While the general sessions will not begin until Wednesday morning, there are already as many here now as have attended some of the previous conventions. The interest as indicated by the attendance indicates a big future ahead for the association. Some of the members have been here a week, and some two weeks, enjoying the famous inland resting place.

To-day and to-morrow are devoted to committee meetings. One of the hardest worked committees is that on membership. Fifty companies have put their names on the waiting list for membership. This will mean if all are accepted, an increase of about 15 per cent in membership.

Among the things which have created renewed interest in the association is the successful conclusion of the Sherman law criminal action on restraint of trade grounds brought by the Government. Among those present is James H. Wilkerson, who headed the group of attorneys who successfully defended the jobbers.

Big Year Ahead

Business is good and everyone sees nothing but a big year in automotive equipment. In some sections the weather and bad roads have delayed business and in most sections last month is not much ahead of the same month last year because the open winter started buying early and spread out over several months the orders that generally do not come until spring. The year from Jan. 1 is considerably ahead of last year, and the trade is in unusually good condition.

All are agreed that the armistice came at a most opportune time, for production had the winter months in which to adjust itself, and everything was fairly well set when 1919 opened. The Canadian jobbers and manufacturers are in about the same position as those in the states. The roads in Canada have held things back, but they are now going to move.

There are many things to come up at this convention. Among them is the wholesale-only policy for jobbers, the recommendation of which was laid over at the Chicago meeting last winter for further consideration at this meeting.

Strikes Slow Up May Production

Overland Has Resumed Work—Fordson Plant Is Open—G. M. First in Output

CHICAGO, May 29—News of the industry shows continued activity and a struggle on the part of production to catch up with the demand. Looking back over the week so far gone the situation is about as follows:

Willys-Overland resumed operations in thirty of its departments Monday. In spite of the fact that the plant at Toledo was heavily picketed, hundreds of workers resumed their duties unmolested.

Henry Ford & Son which closed for inventory the first of the month, resumed operations ten days ago, but no complete tractors have been produced to date. A fair force of men is being employed in departments which are devoting their attention to the production and assembly of certain parts. Completed tractors will be coming through again in fair quantity by June 1, however.

Production in Michigan and Ohio during May was hard hit by the recent labor trouble, statistics revealing a falling off in daily production of many factories. During the month production averaged 6,688 cars daily as compared with 7,084 daily during April. Strikes in the plants of parts makers was largely instru-

mental for the sub-normal production although in the cases of Willys-Overland and Studebaker No. 3 factory, Detroit, the strikers effectively tied up manufacturing work.

Saxon, Hupp and others were hit by the Wilson Body Co. strike, their supply of bodies being curtailed. The walk-out at Timken-Detroit Axle Co. put the Cadillac and one or two other companies in a bad way, while the Salisbury Wheel & Axle Co., Inc., strike at Jamestown, N. Y., if it develops seriously, is threatening Paige production. Willys-Overland, which was running 600 cars daily at time of the strike in that plant, has not produced a car in three weeks.

Daily production figures for the two states during May follow:

Buick	500	500
Briscoe	75	75
Barley	10	10
Cadillac	100	80
Chalmers	80	80
Chandler	60	70
Chevrolet	700	726
Columbia	18	20
Dodge	500	500
Dort	100	100
Ford	3000	3000
Harroun	15	15
Hudson	100	100
Hupp	75	60
King	10	10
Liberty	30	30

Maxwell	250	250
Oakland	10	12
Olympian	140	159
Oldsmobile	600	200
Overland	25	25
Packard	70	75
Paige	15	13
Paterson	12	15
Reo	125	125
Saxon	50	35
Scripps-Booth	45	50
Studebaker	200	150
Winton	10	10
Essex	100	100
Grant	50	50

Total7084 6688

The estimated output of motor vehicles of all classes by the various units of the General Motors Corp., from July 1, 1919, to June 30, 1920, is placed at 577,000. The estimate is issued by Watling Lerchen & Co., of Detroit, which firm is handling the new \$50,000,000 issue of General Motors six per cent debenture stock. Of this total output cars represent 512,000, trucks 40,000, and tractors 25,000. In addition the company's output of farm implements is figured at 75,000. The company also is preparing to place a line of house lighting systems on the market. In the value of annual output, General Motors now ranks first in the automotive industry and second in the number of vehicles produced.

The Dauch Mfg. Co., maker of the Sandusky tractor, Sandusky, Ohio, reports an order for the immediate shipment of 500 of their 10-20 model J trac-



Typical stretch of road on the link between Yellowstone and Glacier parks, with map of entire route

tors to France to be used in reconstruction work. No difficulties are contemplated in connection with the importation of these tractors under the present ruling of the French government. Two hundred machines on this contract will be the standard 10-20 Model J type, the balance of the order being filled with a new unit construction frameless type model which the Dauch company has perfected. The French parties have made a substantial cash payment and shipments are going forward at the rate of twenty-five a week.

GAS ENGINE MEN IN SESSION

Chicago, June 2—That there will be no radical changes in prices in the gas engine in duty for an indefinite time to come was the assurance brought by Floyd R. Todd of Deere & Co., who addressed the national gas engine association at the afternoon session today. His address went carefully into material and labor conditions and he was emphatic that until these change materially it is useless to expect a reduction in gas engine prices.

Attendance was smaller than usual at the first day's sessions of the National Gas Engine Association. The experiment of group sessions was tried for the first time, with but indifferent success. Hardly any of the speakers who were expected to be present the first day put in an appearance.

The opening session this morning was devoted to routine business, including the annual address of President Fischer. In this reference was made to the more or less serious labor difficulties confronting the members of the association and the organization was admonished to consider these problems carefully. The president also suggested a broadening of the scope of the organization, with a change of name, in order that manufacturers of all varieties of internal combustion engines might be admitted to membership.

Various group meetings were scheduled for the afternoon, but hardly one of them did anything.

Chicago, June 3—The National Gas Engine Association at to-day's session adopted the new constitution permitting of sectional organization and the executive committee voted to admit farm light plant manufacturers as a subsidiary section.

These Dealers Will Pool Fordsons

Action Taken to Clean Up All Tractors Now On Hand Before the New Price

CHICAGO, June 2—Representatives of the 131 Fordson dealers in the Rue Motor Co. territory comprising twenty-four counties in northern Illinois and twelve counties in northern Indiana, met here today and took unprecedented action to clean up the tractors now on hand. It was decided to pool all the tractors remaining unsold at the present time in the Rue domain and divide them equally among the dealers.

There are on hand at the present time less than 450 unsold machines in this territory, making only a little more than three for each dealer, or about enough to cover his demonstration needs during the coming harvest season. The reason for taking this action at this time is that a new price on the Fordson tractor is to be announced in the near future and none of the dealers who had any number of tractors on hand wanted to be caught in that condition.

Another reason assigned was that by cleaning up unsold tractors at this time the factory would be enabled to resume construction and have tractors on hand for shipment to meet the anticipated harvest demand. A telegram to this effect was sent to the factory.

In addition the general tractor situation was discussed thoroughly and plans laid for an aggressive campaign during the summer and fall selling season.

TO LINK NATIONAL PARKS

Helena, Mont., May 31—The first link in a great motor highway connecting the National parks will be opened June 20 for regular motor transportation. It has been designated as the Geysers-to-Glaciers Motor Trail. Ten-passenger motor buses will be operated on regular daily schedule, and a fleet of 275 cars will carry tourists between Yellowstone and Glacier parks. Early in July the second link will be ready. This will be the road connecting Rocky Mountain and Yellowstone parks. It is the aim of the Government to develop a well-defined motor highway joining also Glacier, Mount Ranier, Crater Lake, Yosemite, Mesa Verde, Sequoia national parks and the Grand Canon of Arizona.

Representatives of the Bureau of National Parks and the park transportation companies toured the link between the Yellowstone and Glacier this month and believe it to be the most wonderful scenic highway in America. The distance is 387.2 miles. The passenger buses will run from Yellowstone entrance, make the distance from Mammoth Hotel to Bozeman, 89.6 miles, during the morning, stop an hour for lunch at Bozeman, go on to Helena, 102.1 miles away. The second day's journey takes the motorist over the best roads in Montana. The drive from Helena to Choteau is 106 miles and from Choteau into Glacier park 89.5 miles.

MICHIGAN GETS 150 TRUCKS FOR ROADS

Lansing, Mich., May 29—The Government has given the state 150 Army trucks for Federal Aid road work. These trucks will be lent to the counties but they must remain in the name of the state.

The legislature will convene June 3 to enact laws to provide for the expenditure of the money which will be raised by the sale of \$50,000,000 worth of state highway bonds. A bill creating a highway improvement loan has been prepared. This bill specifies that a board composed of the governor as chairman, state treasurer, attorney general, auditor general and state highway commissioner shall supervise all road construction work.

U. S. TO STIMULATE NATIONAL PARK TOURS

Washington, May 29—A plan to stimulate tours in the Rocky Mountain, Yellowstone and Glacier National parks will be inaugurated by the Department of the Interior. Larger touring cars of seven and ten-passenger capacity will be placed in operation and driven through the parks for tourists. The tour lines will run over roads through the three national parks via Boulder, Loveland, Livingston, Bozeman, Townsend, Helena and Choteau.



More than 200 Ford dealers met at Charlotte, N. C., recently, when this photograph was taken. W. A. Ryan, x, sales manager at the main plant, attended the conference. J. W. Holt, xx, manager at Charlotte, was host

Motors Do All Except Plant Corn

They Will Do That Next Year and This Farm Will Be Horseless Indeed

THE horseless farm is not here yet perhaps, but it is not far in the distance. When one man with a tractor can farm 160 acres there isn't much left for horses to go. Give him a motor cultivator and a motor truck in addition to his tractor, and every necessary operation on the farm can be performed without the horse. And he will do his work quicker, better and cheaper than it was possible for him to do it with horses."

So says J. M. Rankin, manager of the C. S. Brantingham farm at Rockford, Ill. How nearly he has approached the ideal horseless stage this year is revealed when it is understood that so far every bit of the work that has been done since spring opened, with the exception of the planting of the corn, has been done with motorized equipment. Not a horse has been at work on the place. Even the corn planting would have been done by motor had the Emerson-Brantingham Co. succeeded in getting its motor corn planter out in time. This will have been accomplished by next year.

Two Tracts in Farm

The Brantingham farm consists of two tracts, one of 200 acres and one of 105 acres. This year 185 acres are in crops, 120 in corn and 65 in small grain. In all 140 acres were plowed, only 20 of which were touched last fall. About 45 acres were disked and dragged. One 12-20 AA E-B tractor, one E-B motor cultivator and a 1-ton truck comprised the motorized equipment of the farm and did all the work except the corn planting. This included the plowing and fitting.

The Brantingham farm is in a sense unique. It is owned and operated by C. S. Brantingham not for show, but for profit. The farm is a combination of diversified farming, stock raising and dairying. The equipment is general and is designed to be the latest and best for the various agricultural industries represented. This refers to buildings, operative equipment and mechanical accessories, all of which are of the latest and most approved kind.

J. M. Rankin, for several years with the United States Department of Agriculture and last year manager of the Government experimental farm in Maryland, is engaged to manage the farm and he is expected to manage it so it will show a fair return upon the investment. He is supposed to accomplish this by employing the best cultural methods and to have at his disposal such equipment as shall make those methods effective. For this reason he is motorizing the farm completely, for he believes that that is the best and most modernly conceived road to agricultural success.

One thing stands in the way of using

By Fred M. Loomis

Motor Age Editorial Staff

the Brantingham farm as a model for a motorized farm. This is because all the machinery designed by the Emerson-Brantingham Co. is tried out and developed on the farm. Also the E-B Co. uses it as a demonstration farm. For this reason the cost results cannot be regarded as average or standard because it is impossible to differentiate at all times between regular work, test work and demonstration work.

Despite this one handicap, however, the farm is an actual demonstration of the possibility of using motorized equipment for every essential operation connected with diversified farming, stock raising and dairying.

In addition to the plowing and fitting, the tractor is used on the belt for silo filling and threshing. Last year it and a motor cultivator divided the honors when it came to harvesting both the small grain and the corn. Stationary gas engines are relied upon for such localized work as corn shelling, feed grinding and the like, while similar installations take care of the dairy and household appliances. Manure spreading, seeding, mowing, harvesting, haying and all the chore hauling about the place are done by the motor cultivator. A motor truck takes care of the road hauling. Next year the

corn planting will be done with a motorized planter.

Mr. Rankin is particularly optimistic about the future possibilities of the motor cultivator. He thinks it has a wonderful future on the farm. He says that in the hands of a skillful operator it will do all the usual team and chore work about the farm and will do it more satisfactorily than it is possible to do it with horses. It is quick, handles easily and always is ready. There is no harnessing and unharnessing of horses, no care or feeding, and when the job is done it is done and there is a lot of time and trouble saved.

As a demonstration of its versatility Mr. Rankin ran it out of the shed, hooked it onto the loaded manure spreader, drove the latter to the field and spread a load of fresh manure, admittedly a hard job, drove back to the barn and maneuvered the loader back into position under the litter carrier in less time than it would have been possible to hitch up a team and do the same work. Then, with the cultivator back in its shed, this particular job was through with for the time being.

The E-B 12-20 pulls three bottoms in plowing and easily handles an 8-ft. tandem disk harrow with an 80-tooth peg harrow in fitting. This last job is equivalent to a ten-horse load.

Operative Costs of Farm

While it is not possible under present conditions to prove without question the economy of motorized farming by what is being done on the Brantingham farm, fortunately it happens that Mr. Rankin last year had charge of the Government experimental farm in Maryland and for the most part used exactly the same equipment he is using this year at Rockford. Operative costs were kept on the Government farm.

On the Maryland farm he kept six horses. All the feed these animals consumed during 1918 was bought on the open market. The six horses ate feed to the value of \$1,327.20, or \$221.20 each. If, as is customary, to this be added the cost of care, veterinary charges, blacksmith services, depreciation and interest on the investment, it is evident that the cost of keeping a horse under present conditions would be practically prohibitive if not necessary.

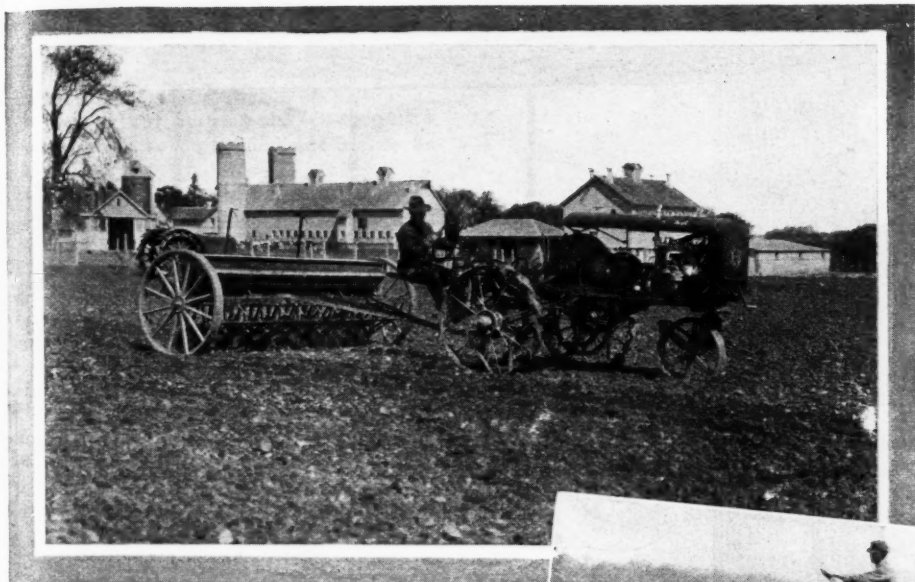
On the Maryland farm both horses and tractors were used for plowing. Mr. Rankin says his figures show that it cost him 95 cents an acre to plow with the tractor as against a cost of \$2.50 an acre with horses. The tractor did all the fitting on the Government farm at an average cost of 17 cents an acre. These figures are interesting and suggestive and go far toward proving the economy of motorized agriculture.

THE SHIP-BY-TRUCK BUREAU

New York, May 30—Firestone has established ship-by-truck bureaus in seven large eastern cities, the latest being at Philadelphia, and expects to spread them all over the nation. The plan emphasizes ship-by-truck rather than the company and tends to bring together shipper and operator in a clearing house proposition, leaving rates to the interested parties. A classified and tabulated list of all trucking concerns, with names and addresses, telephone numbers and routes, has been prepared and includes:

- 1—Companies operating out of city on daily schedule.
- 2—Companies operating out of city on long-distance hauls by request.
- 3—Companies specializing in the moving of furniture, household goods, etc., operating in and out of city at any time.
- 4—Companies hauling anything anywhere any time.

Shippers, including manufacturers, merchants and farmers, are invited to get in touch with bureau by telephone or otherwise. Trucking concerns are asked to supply information as to routes covered, tonnage, capacity of trucks, schedules and rates. A ship-by-truck emblem will appear on all trucks using the bureau, and a special cost system is being planned for concerns using the bureau's facilities.

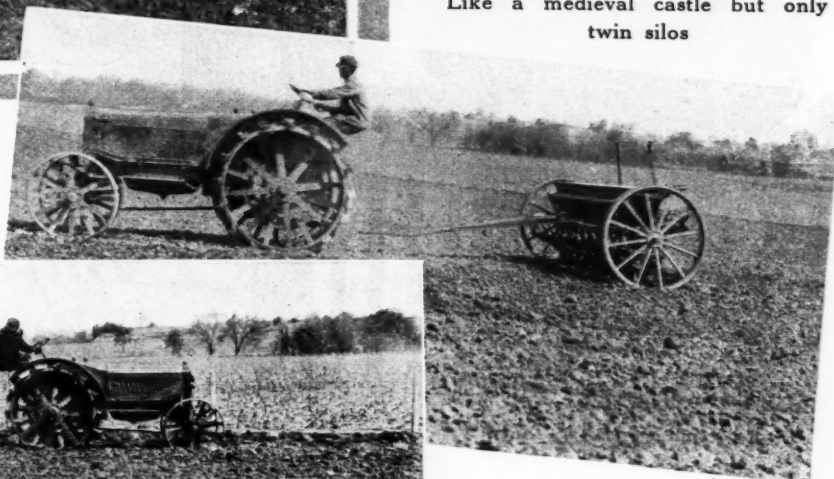


The motor cultivator handles the grain drill all right, above

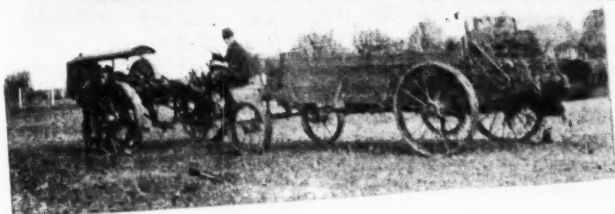
Making the seedbed with the 12-20-
A ten-horse load, below



Like a medieval castle but only
twin silos



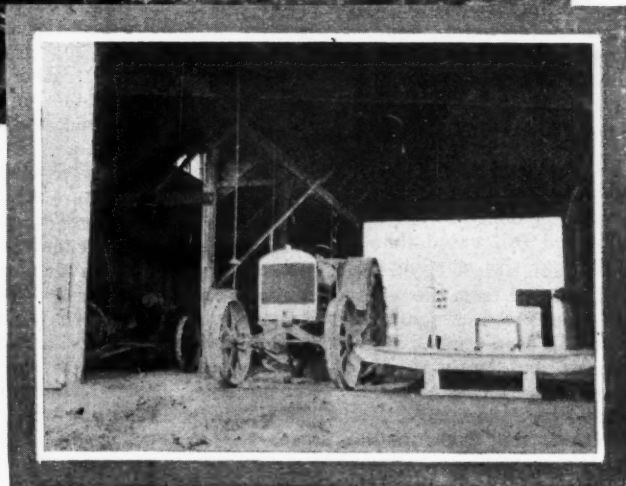
Putting in small grain by
tractor power, a waste
of power



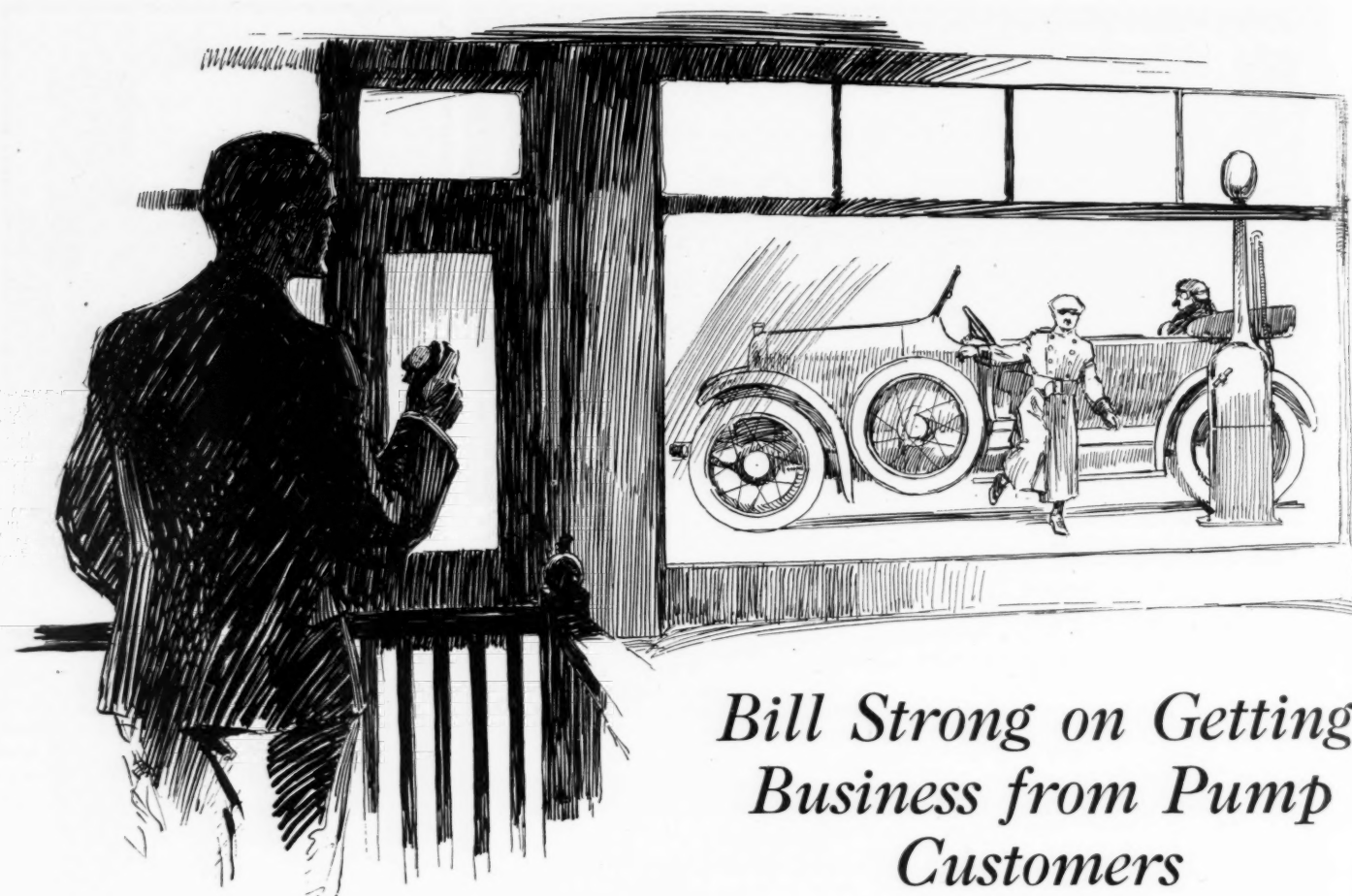
The motor cultivator is a dandy horse on the
manure spreader



Down the row past breeding barns and implement shed on the
Brantingham farm



The implement shed is big enough to house all the
equipment on the farm



Bill Strong on Getting Business from Pump Customers

A PONDEROUS six, glistening green and muchly nickeled, rolled briskly up to the curb in front of the gasoline pump and stopped with a jerk. Out jumped a faultlessly liveried chauffeur and looked around impatiently for the attendant while a bundled figure in the seat behind nervously puffed a fat cigar and shot great wreaths of smoke up through the crisp, cold air. Evidently he was in a hurry.

It was just 15 seconds before the pump man appeared, but it seemed like that many hours judging from the extremely petulant air of the man in the car, and to Bill Strong, Liveburg's well-known garageman, who viewed the incident from the front window of his office, watch in hand, it seemed like twice that time. Bill was a stickler for quick, courteous service and consequently was covered with chagrin at the inexcusable inattention of one of his own men.

Left with Loose Tread

Eventually the gasoline tank was replenished, payment made, and the car tore away as quickly as it had come. As it disappeared Bill noted that the tread on the right rear tire was loose.

He turned from the window, dropped into his comfortable chair and knitted his brows in deep study. Presently he aroused himself and, with an air of relief which betokened a solution of the problem, turned to his stenographer: "Tell Barney Whitman that I should like to see him at once, please."

Barney was employed in the accessory store and in some respects was its most important, most shining personage. He was just out of his 'teens and full of

go, he was the favorite of everyone who came into the store—a favorite both because of his infectious geniality and his boundless energy. Accessory sales had taken quite a jump since the day his tall, angular frame was first seen behind the counter, for he was equally at home with magnate and workingman.

"Barney, I'm going to promote you. You will receive a five-dollar-a-week raise and a commission besides. You will have energy. Always smiling and always on the charge of the curb pump!"

Barney's face took on a puzzled expression. What was the idea? Was Bill crazy?"

"It's a great opportunity, Barney, and I want you to make the most of it. You are just the man for the job, too.

"It's a great opportunity because you are, or rather will be, the main, the most important point of contact between business and customers. This applies to old customers but more especially to new ones.

"My regular customers, except for those who store here, stop at the pump a half dozen times for once they step inside, and new customers may stop at the pump and may never come inside UNLESS the most is made of this initial point of contact.

"Your job of selling gasoline will be only incidental. Your principal function will be to see that no opportunities which come to the pump are missed. At the same time you will give the prompt, efficient dispensation of gasoline and oil which must accompany your other efforts in order to insure your complete success.

"Mr. A, a regular customer, drives up to the pump for gasoline. While you are filling his tank you engage him in conver-

sation and find that his clutch needs overhauling. With your natural diplomacy and salesmanship you land this job for our shop.

"Mr. B drives up with squeaking brakes. Inspection shows that they require relining. You tell him what the trouble is and thus get his business.

"Mr. C pulls alongside the pump and you note that a deposit of rust caused by a boiling radiator covers the front of the hood and radiator. You tell him of the advantages of a radiator thermometer and sell him one.

Little Service Points Count

"Mr. D stops and you see that he has a rear tire with not more than 35 lbs. pressure. You tell him so and inflate it. This little service is cementing him to us. At the same time it affords you an opportunity to display the tire gage which you used—with a good prospect of selling a similar one to him.

"Mr. E. arrives with a car which has recently been washed and polished but the job was poorly done. Suggest to him, diplomatically, that we do a superfine wash and polish, and ask him to try us next time.

"Mr. F. appears with a front tire that is worn down to the canvas. You sell him a new tire.

"Mr. G's car requires painting. You get the business.

"Mr. H says something about the poor job of repairing we did last time he left his car in our shop. You call me immediately so that I can straighten out the misunderstanding before it does any more damage.

"Don't get the idea that every time a

man drives up that you can sell him something but be sure that you DO embrace every opportunity to the utmost and REMEMBER that every time a man stops at that pump that it may be Opportunity knocking. Be sure you find out before he gets away.

"Also, don't make a nuisance of yourself. Use your head. That's one reason why I am giving you the job. You must do this work quietly and inoffensively; if you don't you may drive some touchy people away for good.

"These remarks apply both to new and old customers, but a new customer, in addition, must be impressed with our business as much as possible. If you can get him inside, on some pretext or other, so much the better, but at the very least say something that he will carry away with him, and will eventually bring him back. If possible, get his name so that we can send him sales literature and letters.

"Lacking some other point of approach, I suggest that you say, 'Mr. Man, I believe that this is the first time we have had the pleasure of your business, so by way of introducing ourselves to you I should like to say that our specialty is prompt, courteous, efficient service in every department of the business and that we hope that you will continue your patronage.' This sounds rather formal but put into your own language with your own smile to back it up I know that it will hit the spot. The customer will be pleased, to say the least, to have it noted that he is a new customer. He will be convinced of our liveness.

Importance of Gasoline Pump

"To sum up we are using every means to build our business: Advertising in newspapers and road signs; circular letters and literature; even personal calls, and yet after going to all this effort and expense the chances are good that the customer-to-be will make his initial appearance at the gasoline pump. Now a customer is a most sensitive human being—so sensitive that a tiny straw may change him from favor to prejudice. We may coax him all the way to the gasoline pump and lose him right there just by some little false move, unintentional, unconscious but nevertheless sufficient.

"In most cases you get first chance at him, and furthermore, you may get a dozen chances at him before we, inside, get even one, if we get that. That is why I am giving you this job. It requires ability, aggressiveness and diplomacy. You can be the spear-head, the main contact point of our business. You can bring us all kinds of business, but it requires a good man—I believe you are the man. Now, go to it!"

IDAHO-WASHINGTON ROUTE

Boise, Idaho, May 30—Many of the most inaccessible beauty spots of Idaho will be opened up during the next two years by road construction under a state and federal program for expenditure of approximately \$6,000,000.

Through construction of the final link in the North and South highway in a section which has hitherto been almost impassable, two inland empires, the Spokane, Wash., district and southern Idaho, will have motor communication.



The Willard storage battery service stations a la the gasoline station

Takes Battery Service to Neighborhood

Los Angeles Willard Provides Testing Stations in Residential Districts

AN innovation that marks the latest feature in connection with the subject of service has originated in Los Angeles where, it is claimed, the first gasoline distributing station of the type now popular throughout the country was built. In various localities of the city stations are being erected which will take battery service right into the neighborhood and make it as easy for users of battery-equipped cars to get attention as it now is for them to obtain gasoline and oils. The plan has been originated and put into practice by A. J. Tobey of the Western Auto Electric Company, Willard representatives in Los Angeles. Within the next year or two it probably will be duplicated throughout the country.

At this time eight of the battery service stations are under construction with two complete. In each instance a location has been chosen that is well within the residential districts as there is greater need for this kind of service in those parts. The stations are neat, frame structures finished in white with gray trimming. Mr. Tobey, the originator of the proposition, is a pioneer in the motor car electrical business having entered it in 1912. The battery testing and filling plan which now is customary among all battery dealers in the country was first put into practice by Tobey. In his opinion the battery service station will prove an equally popular move.

"Such strides have been made in the construction of batteries that the chief remaining problem was to see to it that the batteries received the proper care and attention," Mr. Tobey stated. "People become discouraged because of the failure of a battery when it was due to their own neglect usually that the instrument did not function properly. We are now furnishing Willard service to more than 15,000 cars in Los Angeles and the situation had become such that we were going to have to enlarge the main plant to maintain this service. There were some objectionable features to this so we believed it would

really be better to establish small stations throughout the city. We figure that the more complete we can make our service the better our patrons will be satisfied and convenience was one of the main things to be considered. We are trying to get the service as near as possible to points where it may be needed most.

"Each of the small stations will be a completely equipped unit in every way. Each will be prepared to handle battery repair work and recharging as well as give the regular testing and filling service. A stock of rental batteries will be on hand at all times. The stations will be in charge of skilled men practically all of whom have been schooled in our way of doing things. Thirty-four men went from our plant into the service. Many of them now are returning home. We filled their places with competent men during the war and this has created a sufficient force to establish these outlying stations and have them cared for by experts in battery construction and installation. We feel that this way of taking care of the returning soldiers was a happy thought."

HE KEEPS 'EM READING

Roy Stueber, manager of the 555 Tire Service Co., Little Rock, Ark., has inaugurated a new kink in rendering road service to his road patrons. Mr. Stueber has made arrangements with the Arkansas Democrat for a large number of newspapers each evening.

He stamps these words on the front page: "Good evening, sir, here is your evening newspaper. With compliments of the 555 Tire Service Company—a part of 555 service."

When the service boy arrives at his destination he first presents the stranded motorist with the newspaper. "In this way not only is the customer provided with entertainment, but his mind is kept off the job and the service boy can proceed with his work without the usual interruption and correction," he says.

Garage Planning

Service Station Arrangements

No. 57

Planning Basement Garage

Q—We expect to build a garage 73 ft. by 165 ft. on a corner, as shown in the sketch. This building is to have a basement, the slope along the length of the lot being so that we can drive in without using an elevator from the rear. This basement will be used partly for dead storage and we want to use part of it for a large shop, say so that about twenty-five cars could be worked on if necessary. I think it should be separated by a wire partition from the storage space.

The upper floor on the street level will be for all live storage, with the entrance in the center, in front. A show room will be on one side with the office, stock room, etc., on the other side. A wash room and vulcanizing place should be up near the front. All Ford parts will be kept in the stock room in bins, and space should be provided for a stock of about 75 or 100 castings, and tubes. Six or seven men will be employed in the shop. We want to have space for as many storage cars as possible on the main floor after space for the other places are used up. According to the enclosed sketch, which gives my idea in a rough way, there is to be a store, not operated by the garage, 18 by 60 ft. on one side. Posts will be placed along one side, something as shown, to get away from too long trusses. What sort of arrangements would you recommend as to the size of these different departments, storage arrangements, etc.—University Ave. Garage, Madison, Wis.

You will note that instead of placing the entrance between the showroom and the office we have grouped the showroom, accessory store, office, stock and tire repair rooms so that they will take up less space and be more accessible to each other. Tires will be sold and tire repairing handled in the accessory store. Tires for repair will

MOTOR AGE is receiving many inquiries for garage plans which do not give sufficient information to permit an intelligent reply. There are certain things which should be known to lay out the proper plan for a garage, and inquirers are urged in asking for such plans to be sure to include the following information:

Rough pencil sketch showing size and shape of plot and its relation to streets and alleys.

What departments are to be operated and how large it is expected they will be.

Number of cars on the sales floor.

Number of cars it is expected to garage.

Number of men employed in repair shop.

And how much of an accessory department is anticipated.

be kept on the lower rack of the stock room and new ones on the upper racks.

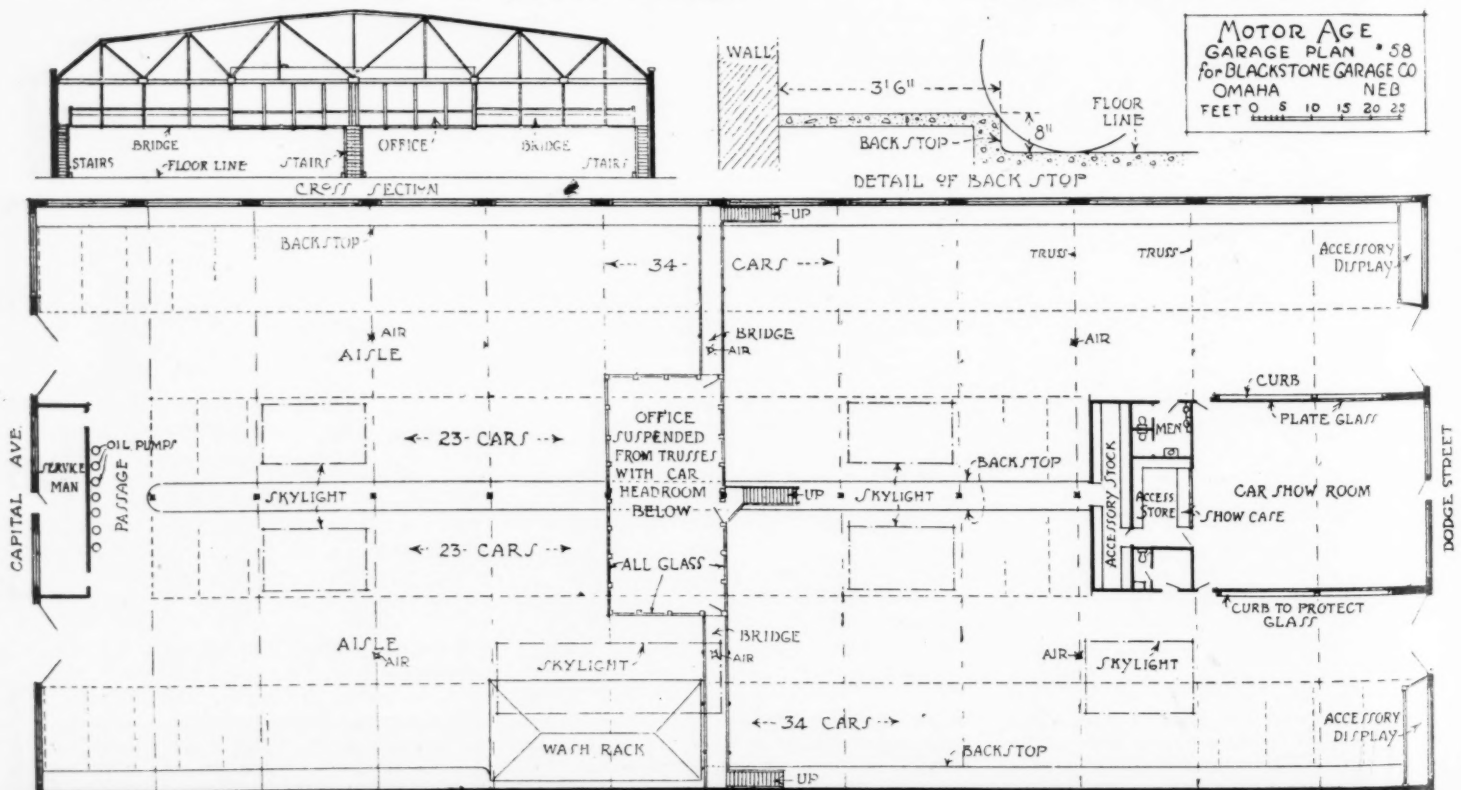
We have carried out the post idea as you suggested, but think it would be still better to move them over to the center of the building and use two short trusses instead of the long ones. The posts at points X would be no more in the way than where you suggest and would cut down your truss cost considerably.

The repair shop is located on the University avenue side of the basement in order to reap all the advantages of light offered at the lower end of the hill. It will not hold twenty-five cars and have any room for the workmen, but we believe it would hold more cars than your force of men would be able to work on simultaneously, and if cars are held up for parts or supplies they can be run out into the aisle behind the shop. As your entrance is rather long and you have room it should be wide enough for two cars to pass.

No. 58

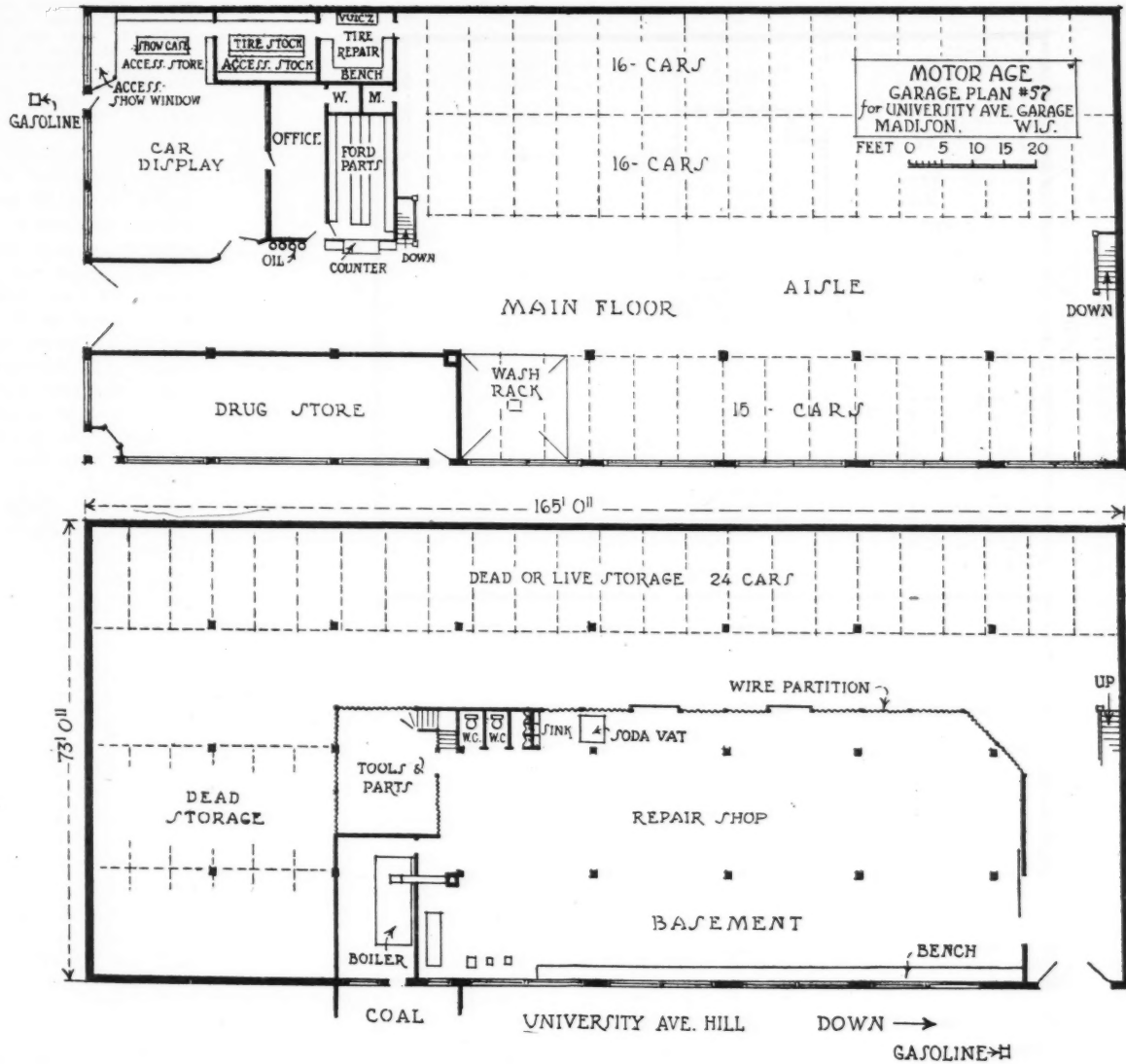
Garage for Storing Only

Q—We expect to build a garage on a lot 100 by 238 ft., located on a northwest corner. We wish to devote all space possible to the storage of cars. We do not expect to operate a repair shop, and the office will be located as indicated, in the center of the building, being suspended from the roof, and will be of either double strength or plate glass. The wash rack will be directly opposite the office in the center of



Garage so designed as to provide all the space possible for storing cars with office in center of building

Garage with basement so arranged that cars can drive in without using an elevator



the building in order to make communication easy. Our air service will be suspended from the ceiling, being installed with the recoil spools. Between the entrance at the front of the building on Dodge street we will have a battery of six oil pumps, three on either side. Between these it is my intention to construct a bay window, and the heavy black lines on attached sketch would be the accessory sales and stock room.

We have allowed from either wall $3\frac{1}{2}$ ft. for back stop rail, then $14\frac{1}{2}$ ft. for car parking, giving us 14 ft. aisle. The center cars would be stored back to back, thus allowing 7 ft. between the two rear ends for back stop rails.—Blackstone Garage Co., Omaha, Neb.

You have a very good and original plan sketched out and we can see no reason why it should not be thoroughly practical. The plan we show, with a few exceptions, is just as you have indicated it to us. We do not know exactly what you mean by a "back-stop rail," but would suggest that this be in the form of a concrete curb that would not be high enough to injure tail lamps or tire brackets but still be a very efficient stop.

You show two posts in your sketch which we do not understand unless, as we have shown, they are for the support of the roof. The plan lends itself very nicely to a row of posts through the center and would make the trusses much simpler than would be necessary for the whole 100 ft. space. The two forward trusses should be designed differently, to be supported on posts in the showroom walls, thus avoiding a post in the center of the room.

There are a few discrepancies in your

plan that necessitate changes. The main one is that you indicate a store 30 by 40 ft. in the corner where there is a space only 18 ft. wide between the wall of the Forty-ninth street side and the aisle. Wouldn't it be better to centralize the three interests you have distributed across the front of the building in your sketch by combining show room, accessories and toilets? They are architecturally and practically much better as we have shown them. You can also gain all the window space for advertising value. You lose, however, the display windows on the Forty-ninth street side but you would have to make a turn in the aisle on that side and probably only have one entrance in front, if you locate the store in the corner. We rather like the snappy systematic appearance of the plan as we show it.

We think there should be two exits in the rear as there would be slight gain with one and in winter you can keep one door locked. The passage between the aisles makes a good place for your battery of oil pumps. Inasmuch as you have no repair shop you need a man to make minor adjustments and diagnose troubles and we have provided a place for him between the rear doors. He might be able to send a lot of repair business to your other garages through talking with customers as they are getting oil, having carburetor adjusted, etc.

We have supplemented your hanging of

fice with a bridge so that the foreman can get a clear view of the whole interior of the building.

No. 59

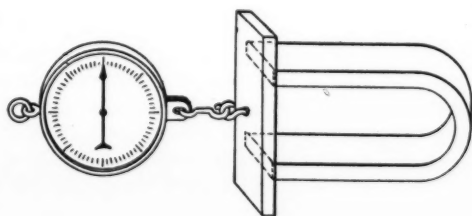
Garage with Natural Ramp

Q—Send us sketch of garage for corner lot 75 by 90, extending through the block, the rear of lot being 18 or 20 ft. lower than the front of lot. The rear of lot is on railroad track. We will have about five mechanics and workroom downstairs, expect to have battery equipment, acetylene welding and vulcanizing. The office, salesroom, store and toilets will be on main floor. Do you advise putting stockroom of parts on basement floor? Expect to store about twenty-five cars on top floor and some in basement. Think we will find an electric elevator necessary.—Nivert & Son, Glasgow, Mo.

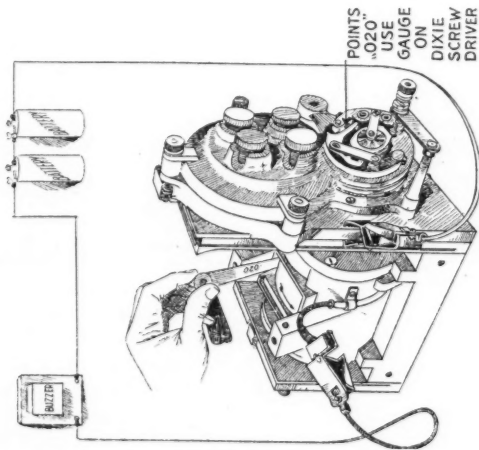
There is no reason why you should have an elevator for this garage. The hillside street forms a natural ramp, which will save you a great deal both in installation and maintenance. If a small elevator, perhaps an automatic or dumb waiter is considered desirable.

Instead of going clear to the foot of the hill for the side entrance, we have stopped just far enough down to give good headroom of 11 ft. 6 in., or 12 ft. In this way less excavation is necessary and the shop will be high enough so that a line of freight cars will have no effect on the light. The width of First street is such that no great advantage would be gained by an entrance from it

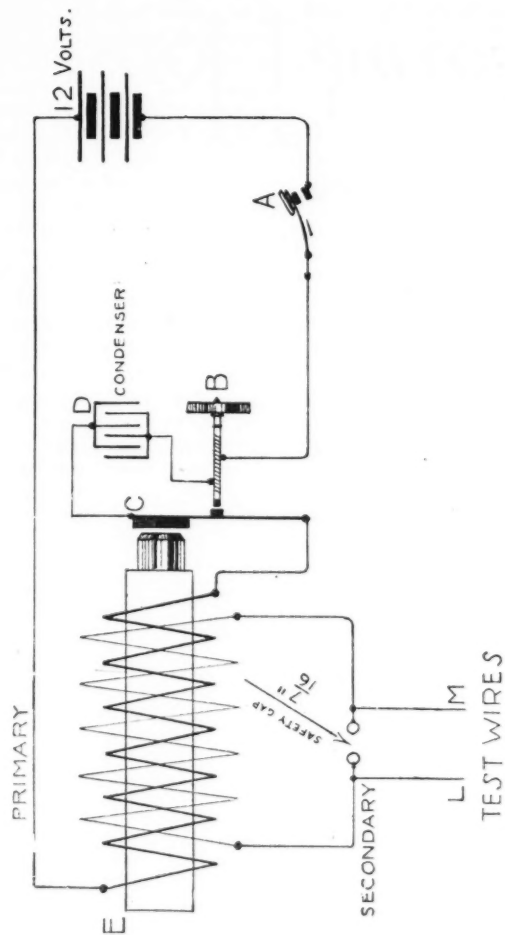
Motor Age Wiring Diagram Chart No. 31



Determining pull of magnet



Using test buzzer to judge when contact points open



Testing outfit for use with windings and insulating parts of magnetos

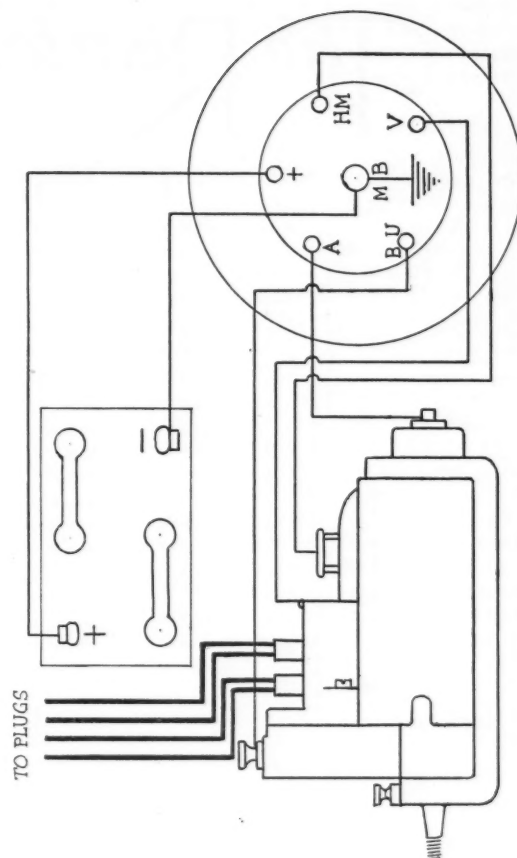
Abbot—March 20-27
Alco—April 24
Alter—Nov. 4
Apperson—March 6
Buick—Nov. 21-April 3
Cadillac—Dec. 9
Cartier—May 1
Cole—Jan. 23-April 3
Case—Feb. 27
Chalmers—Feb. 20
Chandler—April 3
Chevrolet—Nov. 28-Mar.
27

Davis—May 8
Detroitter—March 6
Dodge—Dec. 12
Dort—March 13
Elgin—Feb. 27
Empire—March 13
Ford—Jan. 30
Grant—Feb. 27-March 27
Henderson—April 3
Hudson—Dec. 5-May 1
Hupmobile—Feb. 13
Interstate—March 13

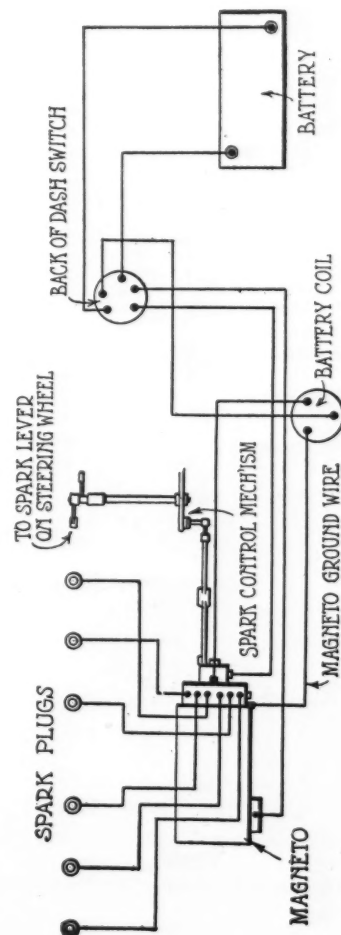
Krit—Feb. 6
Lexington—April 24
Little—March 20
Locomobile—Jan. 23-April 17
Maxwell—Jan. 16
Marion—March 6-20
Mercer—Jan. 23
Michigan—March 20
Mitchell—Jan. 9
Murray—May 1
Oakland—Jan. 2
Oldsmobile—Jan. 23

Special Systems for Fords—May 15-22
General Battery Charging—May 29

THIS WEEK—General Magneto Diagrams



Mea magneto and coil, showing manner of connecting units. The heavy lines are the high-tension wires to plugs



Connections of Splitdorf model L magneto

The Readers' Clearing House

Questions and Answers

Tires Slide on Rim

Q—What is the cause of tires slipping on rims so as to pull valve stems off? The car has done this repeatedly and apparently without cause.—John J. Fowler, Eldora, Iowa.

Valve tearing caused by the tire slipping on the rim may be attributed to either, or both, of two reasons. The rim may have been flattened slightly by running without a tire or with a blown-out tire. The tire you are using on the rim may have been run a few miles in a deflated condition. This would cause the tire thread to stretch, making it fit the rim very loosely. If the rims are injured in any way, it is best to get new ones and if it is due to a poorly fitting tire, a new tire will remedy the trouble. Proper tire pressure always should be maintained.

Adjusting Clutch and Axle

Q—Give instructions to remedy a grabbing clutch on a Studebaker.

2—Give instructions to take up bearings in the differential. How tight should they be?—Ervin Spaulding, Turk, Wash.

1—The leather on a cone clutch should be treated occasionally with a little neats-foot or castor oil. Never use lubricating oil for this, as it will cause the clutch to slip. If your clutch grabs or slips, clean the facing with gasoline and apply the neatsfoot or castor oil. A clutch of the cone type generally grabs when the leather has been allowed to become dry.

To apply oil to the clutch facing remove the board from the floor of the car immediately in front of the front seat, cut a stick of wood just the right length to hold the clutch out by bracing the clutch pedal forward from the front seat. If the leather on your clutch is scorched badly as a result of slipping the clutch too much, you will need a new leather. This calls

Conducted by B. M. Ikert

Miscellaneous

for the removal of the clutch cone, which can be done as follows:

Take out the rear plug in the clutch hub, depress the clutch pedal, insert small punch in this plug hole so that the clutch engaging spring will be held depressed on removing retainer nut on end of crankshaft. We are showing a sectional view of this in Fig. 3. Next, remove the clutch throw-out shaft by removing the two bolts at each end holding the shaft throw-out bracket to the sub-frame and the nut in the center to which the clutch

throw-out yoke is fastened. Take out the four bolts which hold the flexible disk to the transmission pinion flange and the six machine screws which connect the flange to the clutch cone. This will allow you to remove the universal joint assembly. Take off the nut on the end of the crankshaft and remove the clutch cone.

New leather for the cone can be had from the factory or dealer and comes with the ends cemented, so you will have little trouble in slipping it over the cone and riveting it in place. It may have to be driven in place with a wood or rubber mallet. Soak the new leather in neats-foot oil for about 15 min. and stretch it over the cone. Be sure to clinch the copper rivets properly so that they are driven down far enough to have the heads below the surface of the leather. If this is not done, the clutch is likely to grab.

2—We assume you want to remove play in the teeth of the ring gear and pinion. This adjustment can be made by removing the differential case cover, cleaning the grease from the parts and then loosening the two differential clamp nuts shown in Fig. 1. The adjusting nuts now can be moved either in or out, whichever way the bevel gear is to be moved. When one nut is turned out the other is turned in the same distance. This does not affect the tightness of the Timken bearings but simply moves the whole differential side-wise.

If this does not take out the play, you also will have to adjust the pinion, which can be done by removing the pinion shaft

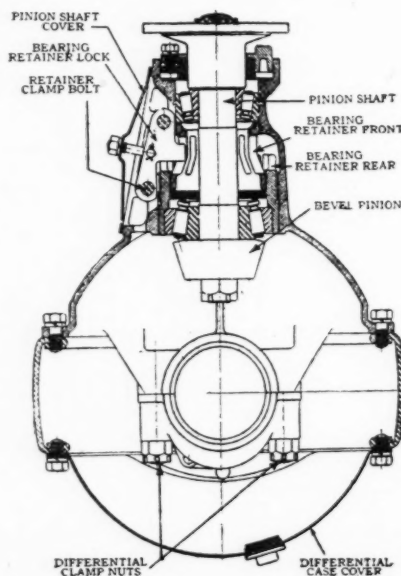


Fig. 2—Adjustment for bevel pinion on Studebaker

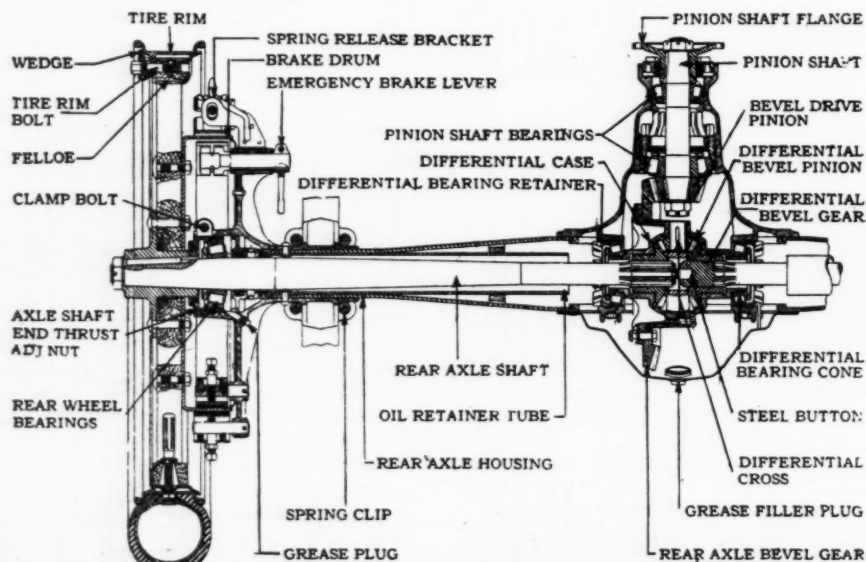


Fig. 1—Adjustments for bevel drive pinion and ring gear on Studebaker

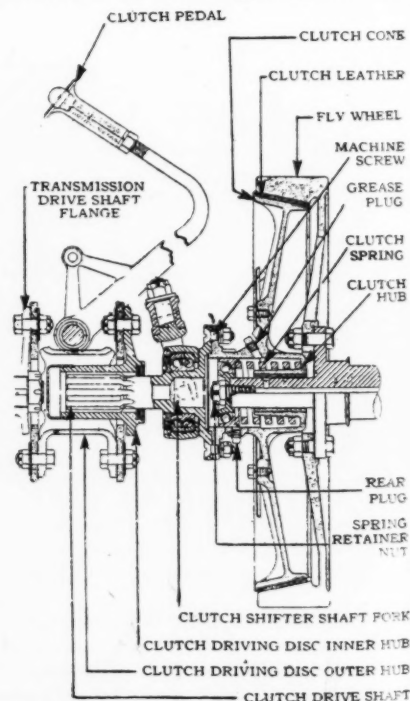


Fig. 3—Cross-section of clutch on Studebaker, with adjustments

cover and two retainer clamp bolts, lifting out the bearing retaining lock. With the aid of a screwdriver or other flat tool, both the front and rear bearing retainers may be turned together in the desired direction that pinion shaft is to be moved. The front bearing retainer is for taking up end play that might develop in the pinion shaft. If they are turned together, this will not disturb the end play adjustment.

Studebaker as Ice-Wagon

Q—Publish suggestion for converting a Studebaker 17 touring car into a light truck capable for hauling about 1 ton of ice.—G. P. Schnegg, Bluffton, Ohio.

This is shown in Fig. 4.

This Mitchell Rides Hard

Q—This Mitchell light four rides freely with a load, but rebounds too much. What kind of an attachment shall I put on to minimize this trouble, which is principally in the back seat?—E. D. Poffenberger, Portsmouth, Ohio.

If the springs on the car have become rustbound, the rebound action will be increased considerably. A mixture of grease and graphite forced in between the leaves of springs will help very much to give the springs their required flexibility. It might be that you are imposing rather severe conditions upon the car and if so, you should fit shock absorbers.

Clutch Kicks Back

Q—I installed new clutch bands, etc., in a C-35 1917 Crow-Elkhart and now experience quite a pronounced vibration and kickback to clutch pedal when first applying pressure in disengaging the clutch. On the original clutch this kickback occurred only when the clutch pedal was shoved forward to the limit and clutch bands fully released. Will this prove detrimental to clutch efficiency later on?—A. C. Granger, Chicago.

The new clutch facing you installed probably is too thick. When a disk clutch of this kind is equipped with very thick facing the plates are very apt to catch on the reverse side, causing a kickback such as you describe. By treating the facing with neatsfoot oil you will eliminate a good deal of this trouble. As soon as the facing is worn somewhat this kickback action should stop.

Burning Out Cylinders

San Gabriel, Cal., Editor MOTOR AGE—An inquiry appeared in the April 7 issue of your magazine concerning the production of a gas used as oxygen for burning out cylinders. The original article to which the inquirer refers was published in "Popular Mechanics Shop Notes" some years ago. If the gentleman will use chlorate of potash, four parts, and black oxide of manganese, two parts, both by weight, in his tube; heat the mixture and lead the produced oxygen to the cylinders, I think he will be successful.—Joseph Shawhay.

Novel Ford in India

A rather novel type of body mounted on the standard Ford chassis is being marketed by the Ford Automobiles, Ltd., Bombay, India. The frame in this case is lowered 4 in. by special fittings. Wire wheels are fitted, with a spare on the rear. The instrument board in the scuttle dash is fitted with a clock, speedometer and switches. There is a tilting steering

TO assist readers in obtaining as a unit all information contained in this department on a certain subject MOTOR AGE segregates inquiries into divisions of allied nature. Questions pertaining to engines are answered under that head, and so on.

MISCELLANEOUS

John J. Fowler.....Eldora, Iowa
Ervin Spauling.....Turk, Wash.
G. P. Schnegg.....Bluffton, Ohio
E. D. Poffenberger.....Portsmouth, Ohio
A. C. Granger.....Chicago
Joseph Shawhay.....San Gabriel, Cal.
C. W. Spring.....Cupertino, Cal.
J. W. Miller.....Brooklyn, N. Y.
Herman Hodges.....Saratoga, Tex.

THE ELECTRIC SYSTEM

S. H. Adams.....Silvis, Ill.
Jesse L. Young.....Memphis, Tenn.
Coward Yeilding.....Camp Bragg, N. C.
C. E. Meier.....Benton, Iowa
Henry E. Bock.....Omaha, Neb.
Charles A. Barker.....El Paso, Tex.
Herman Hodges.....Saratoga, Tex.
F. S. Newton.....Omaha, Neb.
L. Todd Owens.....Appollo, Pa.
G. R. Miller.....Akron, Ohio

ENGINES

Henry R. Chattin.....Valparaiso, Chile
C. H. Igeback.....Chicago
G. R. Miller.....Akron, Ohio
C. R. Johnston.....Ashtabula, Ohio
H. R. Bowton.....Galesburg, Ill.
T. C. Jenkins.....Auburn, N. Y.
Harley Oneal.....Rankin, Ill.
G. W. Aiken.....Toledo, Ohio
E. Sebens.....Hamlet, Ind.
Henry Haverkamp.....Kelly, Kan.

LUBRICATION

Robert Biggs.....Tiffin, Iowa
James E. Boyes.....Detroit
A. G. Gary.....Walker, Iowa
Robert L. Boyer.....Newman, Ill.
H. Clay Penick.....Bakersfield, Cal.

CARBURETION

Milo J. Yanecek.....Walford, Iowa
J. F. W. Lange.....Rockport, Tex.

REBUILDING

Julian F. Braser.....Chicago
George Earnshaw, Jr.....Youngstown, Ohio
H. Hobson.....Rockford, Ill.

No communication without the writer's name and address will be answered in these columns.

wheel, and the rear compartment cover swings back to form a rest, so the car can be made into a four-passenger easily. All the fittings, including the radiator, are nickel plated.

The engine is fitted with a Zenith carburetor and a synchronized high- and low-tension ignition system, which uses current from the Ford flywheel magneto or battery, if desired. The result is a slow-running engine, combined with the absence of rattle, eliminated by keeping the mud guards clear of the body and fitting canvas valances instead of the usual metal aprons.

This car has attracted quite an amount of attention in Bombay, and the company is supplying it now to order.

General Ford Questions

Q—Which is better for a Ford and why, a high-tension magneto, master vibrator or regular Ford magneto equipment?

2—What company makes a water circulation pump for a Ford?

3—Will a force circulation pump keep the engine cooler and give more power and mileage on gasoline?

4—What is the best mileage per gallon of gasoline that can be got out of a cut-down Ford, regular equipment?

5—What is the best speed on a good road?

6—Do you advise oversize tires for touring on a cut-down Ford?—J. W. Miller, Brooklyn, N. Y.

1—There is no reason why the regular Ford magneto equipment will not work satisfactorily if the contacts on the coils are adjusted properly. If a master vibrator is used, the possibilities of securing an evenly-fired spark in each cylinder are increased. This leaves only one contact to be adjusted instead of four. With a high-tension magneto the only adjustment is on the breaker points. This with the general

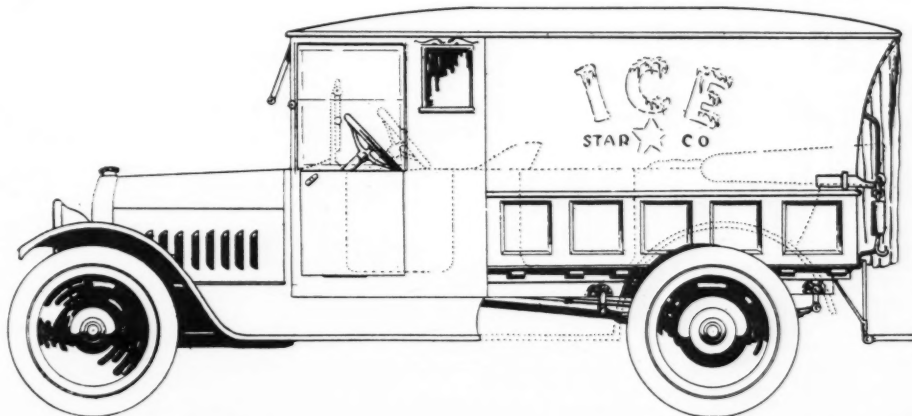


Fig. 4—Suggestion for converting a touring car into ice wagon

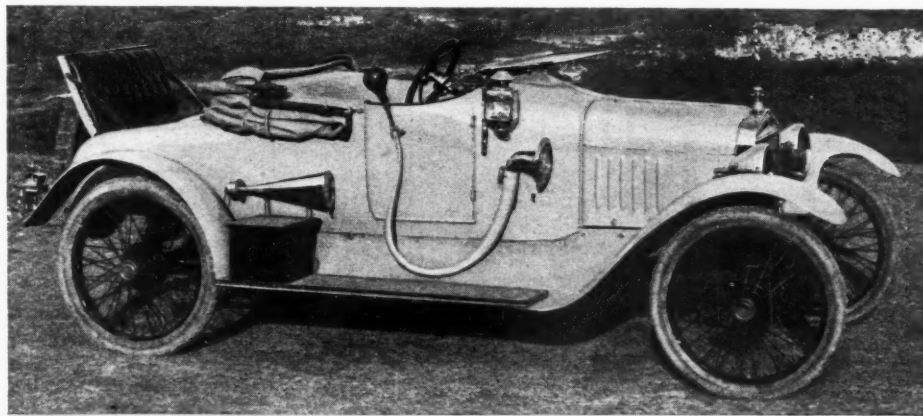


Fig. 5—Novel type of body mounted on Ford by concern in India

reliability of the magneto makes its use worth considering.

2—Water circulators for Fords are made by: G. P. Sales Co., 1806 Michigan avenue, Chicago; Michigan Auto Products Co., Detroit; Parker White Metal & Machine Co., Twenty-third and Railroad streets, Erie, Pa.

3—If the car is to be used for truck purposes, where there is considerable running and low gear, a forced circulator will be of considerable advantage; otherwise the regular Ford equipment should suffice.

4—Gasoline mileage is a question governed by many conditions. To our knowledge the best mileage ever secured from a regular Ford was 31 m.p.g.

5—Speed is also a question governed by many conditions. The condition of the tires, the engine and all the other parts of the car are contributing factors toward speed. We have record of the regular stock-equipped Ford going 45 m.p.h.

6—Oversized tires on a Ford increase the riding comfort of the car slightly. Tire mileage also is increased. It has been claimed that oversized tires on a Ford will outwear the car.

Curing Brake Squeaks

Q—How can I prevent squeaky brakes? I have cut out a 2-in. section on the back of the band, as you suggested some time ago, and stopped the squeak for one day. I have relined the brakes, tried many of the anti-squeaking devices, soaked it in kerosene, etc., but results are only temporary. The brakes always have held all right, so I am wondering if the trouble is in the brake drum.—C. W. Spring, Cupertino, Cal.

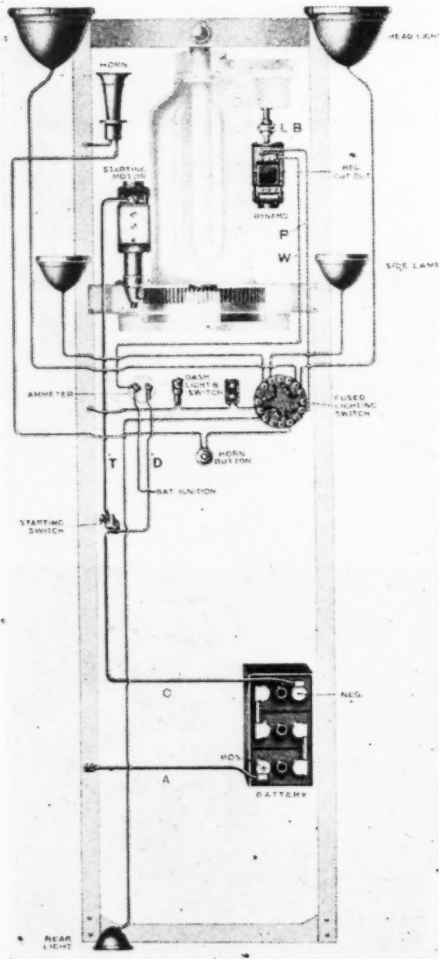


Fig. 6—Gray & Davis electric system

If you have taken all the steps that generally are taken to prevent brakes from squeaking and also followed our special instructions, then there is no doubt something is wrong with the brake drum. It may be that there is a slight misalignment, so that the brake band bears on one spot only. We would advise that the wheels be removed and the axle alignment checked up. Also see that there are no dented portions on the brake drum.

Mercer Engine Knocks

Q—There is a knock in my Mercer 35D when running about 40 m.p.h. Over this speed it seems to run all right.—William Mayette, Jr., Plattsburgh, N. Y.

There are several reasons why your engine might knock. There might also be a combination of these reasons. You tell us very little about the nature of the knock, whether it is a heavy thumping noise or a metallic tapping or whether it is a rattle. We would advise you to read the story on engine trouble in the May 22 issue of MOTOR AGE.

Accessories on Buick

Q—How may a Goodrich cut-out be installed on a Buick E645 model 18?

2—How may a Kellogg tire pump be installed on the same car?

3—What has been the fastest speed made by any airplane?—Herman Hodges, Saratoga, Tex.

1—Directions for installation always accompany accessories. This cut-out is installed by slipping the cut-out over the exhaust pipe where a section of the pipe has been removed.

2—There are several methods for in-

stalling this tire pump. Much of the installation depends on ingenuity. There have been several successful installations where a gear was fitted over the pump shaft, the pump itself being held to the engine by the bolts that hold the bottom pan.

3—There is record of a plane traveling 142 m.p.h.

The Electric System

Empire Wiring Shown Recently

Q—Publish wiring diagram of 1915 Empire, model 31.—S. H. Adams, Silvis, Ill.

This was shown April 24, 1919.

Chalmers Wiring Diagram

Q—Publish wiring diagram of a Chalmers Master six, 1916.—Jesse L. Young, Memphis, Tenn.

This is shown in Fig. 7.

Regulator for Ford

Q—I am equipping a Ford with a Bosch magneto. It is my desire to use the Ford magneto for lighting. What can I prevent the flow of current from exceeding 9 volts?—Corp. Howard Yelding, Camp Bragg, N. C.

The proper thing to use to regulate your voltage is an alternating current reactance coil. This is merely a coil of copper wire which has a continuous iron core. The core might be in the shape of a circle or a square or any shape, just as long as it forms a complete magnetic circuit. It can be built up from several pieces of thin soft iron or magnetic steel, having a cross-sectional area of 1 sq. in. Then about fifty turns of No. 14 copper wire should be wound around one section of the core. This coil should be placed in series with

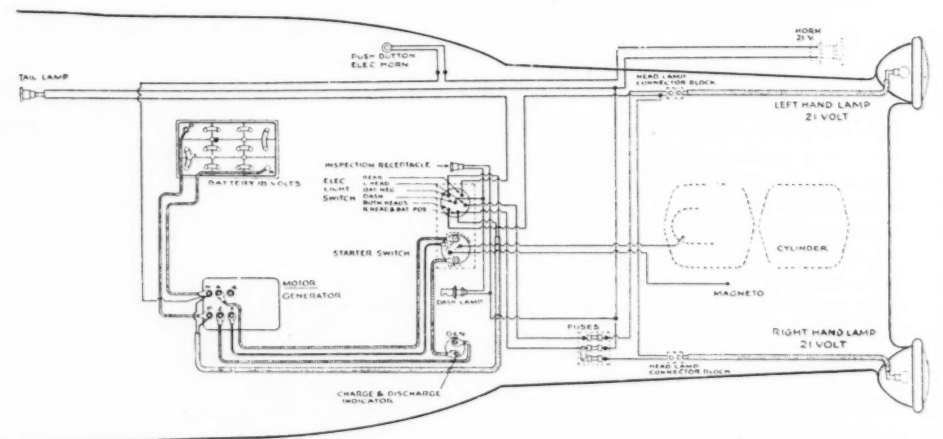


Fig. 7—Wiring diagram of electric system on 1916 Chalmers six

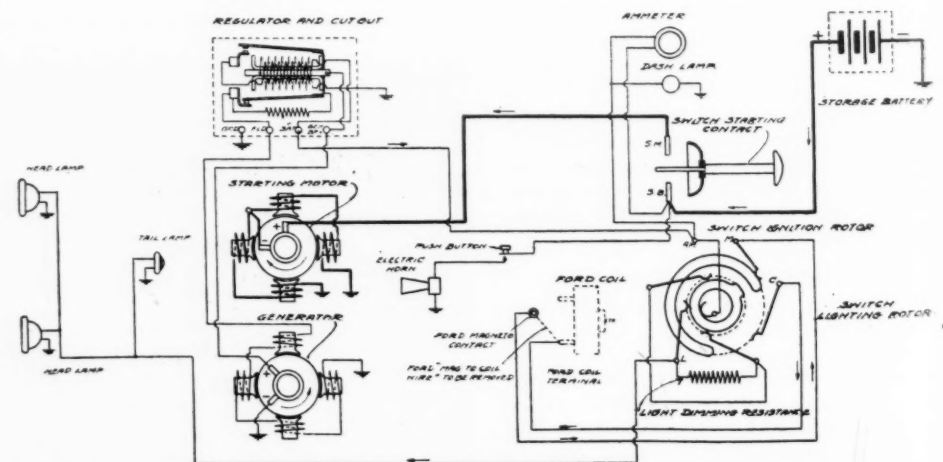


Fig. 8—Wiring diagram of Heinze-Springfield system for Fords

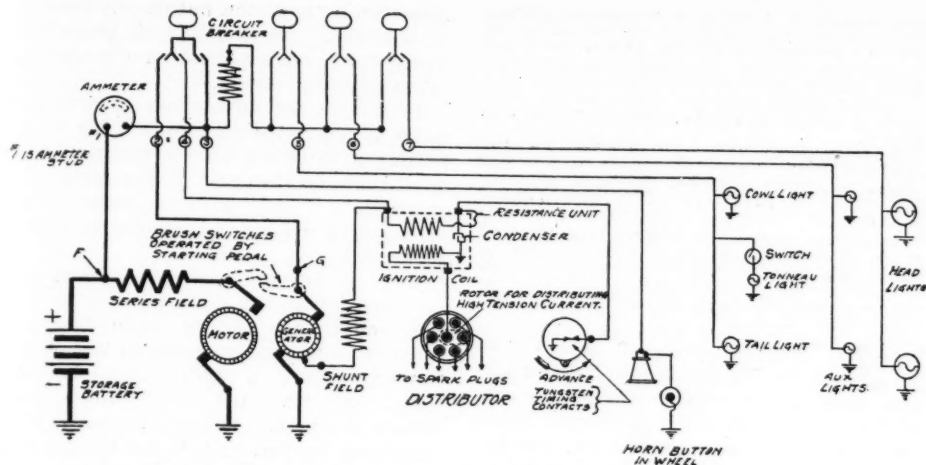


Fig. 9—Wiring diagram of Delco system on the E-6-45 Buick

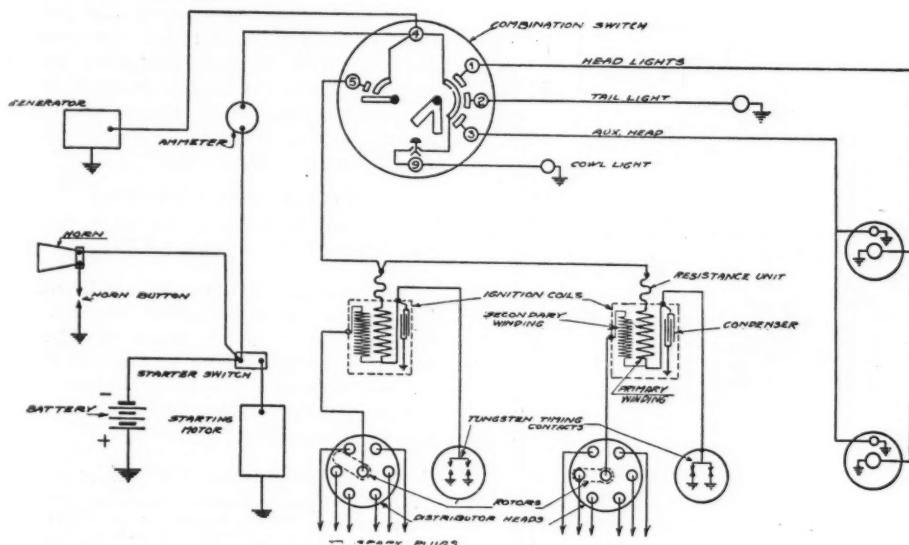


Fig. 10—Wiring diagram of standard Delco electric system

the lamp load. The direct current resistance of this device will be very small, less than 0.5 ohms, but the alternation current resistance will increase as the speed of the engine increases, and it thus will regulate automatically.

Heinze Electric System

Q—Publish wiring diagram of a Heinze electric starting and lighting outfit on Ford car.—C. F. Meier, Bonton, Iowa.

This is shown in Fig. 8.

G. & D. Friction Generator

Q—How can the output or amperage be increased from the generator on the Gray & Davis system that was regular equipment on a 1913 Apperson?

2—Publish diagram of generator and starting motor?

3—What is wrong when the Entz system on a 1914 Chalmers 24 fails to start or turn the engine over when the battery is fully charged?

4—Publish diagram of this motor-generator.—Henry E. Bock, Omaha, Neb.

1—The current on the generator of the Gray & Davis 1913 system is controlled by a frictional governor. The cross-section of the generator is shown in Fig. 11. When the governor was adjusted so that the speed of the generator would not vary from 1000 r.p.m. If it is desired to increase the charging rate, the tension of the spring on the governor must be increased. It is possible that the friction facing is worn, and in that event it must

be renewed. This is done by removing the cap screw B and sliding the housing

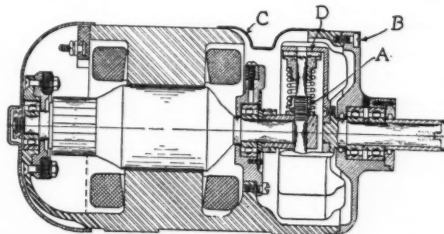


Fig. 11—Cross-section of Gray & Davis generator

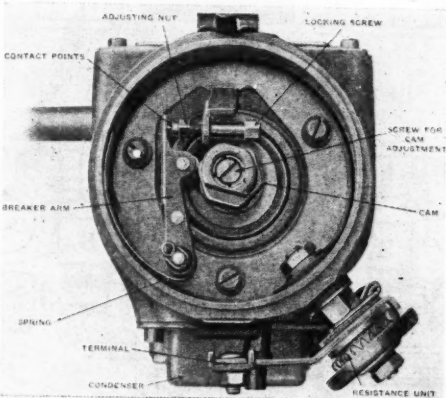


Fig. 12—Hudson distributor, showing adjustments

off the generator shaft. The clutch cone next is removed, and this exposes the frictional material. It is better first to increase the tension on the spring. This is done by removing the cover plate C. By inserting a screwdriver in the adjusting screw and holding the nut A with a pair of pliers the tension can be increased.

2—We have no illustration of the starting motor.

3—Fifty per cent of all electrical troubles are attributed to loose contacts. If the battery is in good condition and there is very little reason why the starting motor should be out of order, then you undoubtedly will find some loose connections somewhere. If you have been in the habit of oiling the battery terminals to prevent them from corroding, it is very possible that a loose contact, together with the oil, is causing the trouble.

4—This is illustrated in Fig. 11.

Owen-Magnetic Wiring

Q—Publish wiring diagram of the Owen-Magnetic.—Charles A. Barker, El Paso, Tex.

The complete diagram of the Owen-Magnetic is shown in Figs. 13 and 14.

Buick Wiring Diagram

Q—Publish a diagram of the Delco wiring system on the E-6-45 Buick.—Herman Hodges, Saratoga, Tex.

This is shown in Fig. 9.

Gray & Davis Electric System

Q—Publish wiring diagram of Gray & Davis electric system, and Bosch dual system as installed on a 1913 National 4-40.—F. S. Newton, Omaha, Neb.

The Gray & Davis system is shown in Fig. 6. The Bosch dual system was illustrated in the May 22 issue.

Wiring Changed on National

Q—I have changed a National twelve from magneto to Delco system. Give complete wiring diagram.—L. Todd Owens, Apollo, Pa.

The standard Delco system used on the series A-K cars is illustrated in Fig. 10.

Timing Hudson Distributor

Q—Give instructions to time a Hudson 1917 Super-Six distributor. At what distance should the contact points be set?—G. R. Miller, Akron, Ohio.

The Hudson distributor is illustrated in Fig. 12. The correct clearance between the breaker contacts is 0.025 to 0.028 in. To time the ignition set the spark lever on the steering wheel at the top and see that the advance rod which connects the advance lever and sector gear at the base of the steering box is not too long, to bind the distributor advance ring. This rod should be adjusted so that the yoke end fits into the advanced lever without any binding when the hand lever on the steering gear is fully advanced. The distributor advance ring will wear rapidly if this adjustment is not taken care of properly.

Open the priming cup on the engine, turn slowly by hand, using the starting crank, until cylinder No. 1 starts to blow. This indicates that this cylinder is on its compression stroke.

Cylinder No. 1 is due to fire in the advance position when the mark A on

the flywheel reaches the pointer attached to the crankcase. This may be observed through the inspection hole on the flywheel housing, left side of engine. Mark A is $\frac{1}{2}$ in. before top center. Now loosen the cam as shown in the illustration and set so that it would break at this point. The adjusting screw on the cam also must be set down tight after changing the adjustment.

Engines

Increasing Engine Power

Q—I desire to increase the power of the engine of a Hudson Super-Six and make the pistons lighter, also increase the compression. My idea is to drill the pistons with a $\frac{1}{2}$ -in. drill. At what distance will it be necessary to make the holes so as not to weaken the walls too much? I prefer

this system to putting in aluminum pistons, as these generally have to be turned to the exact measurement of the actual bore and in addition do not last long with the hard work that is necessary in this country.

2—Can some holes be made in the connecting rods? If possible, of what size and where?

3—Respecting the compression, as the Hudson is an engine of more compression than the current engine, would it be convenient to shape $11/16$ in. to the cylinder head?

4—I also expect to replace the present rings with three Inland. Is it possible to make the lapping with the same pistons already drilled without danger of them remaining quite loose?—Henry R. Chattin, Valparaiso, Chile.

1—The May 29 issue of MOTOR AGE illustrates the method for lightening engine pistons. In the advertising columns of MOTOR AGE you will find several manufacturers of lightweight iron pistons. In many cases these are just as light as

any aluminum piston but do not have the advantage of transmitting as much heat away from the combustion chamber as the aluminum piston.

2—We do not advise you to drill any holes in the connecting rods. The cross-section area of the rods is calculated for a minimum value and giving maximum strength. If this area is reduced the strength of the rods is reduced to a critical value.

3—If it is your desire to lower the compression of the engine, the best way will be to have pistons made having a concave head, although we do not advise any change in the engine design such as this. Reducing the compression will reduce the power. This will reduce the operating temperature of the engine and consequently impair its efficiency.

4—Inland states that since its ring has a uniform cylinder wall pressure it will not need to go through the lapping process. This is generally true of all patented rings. Careful driving for a few miles with a well lubricated engine is sufficient to wear in Inland rings or almost any patented ring.

Timing Harley-Davidson

Q—Publish diagram of the Harley-Davidson twin-cylinder timing.—C. H. Igeback, Chicago.

The timing of the Harley-Davidson motorcycle is illustrated in Fig. 15. Cylinder No. 1 is the front cylinder of the motorcycle. If the valves are timed and set according to piston position on cylinder No. 1, the setting will be correct for cylinder No. 2.

Palge Engine Not Offset

Q—I had the cylinders reground, new pistons fitted and also wristpins on my Palge 4-36, and after the re-assembly of engine it has a distinct knock, seemingly in the forward end, while idling. It also can be heard while driving on level but not when pulling reasonably hard on a hill. The connecting rods are tight, timing gear chains O.K. I think the rear main bearing is a little loose, but it does not sound at the back of the engine.

2—Were the wristpins offset in the piston on this model?

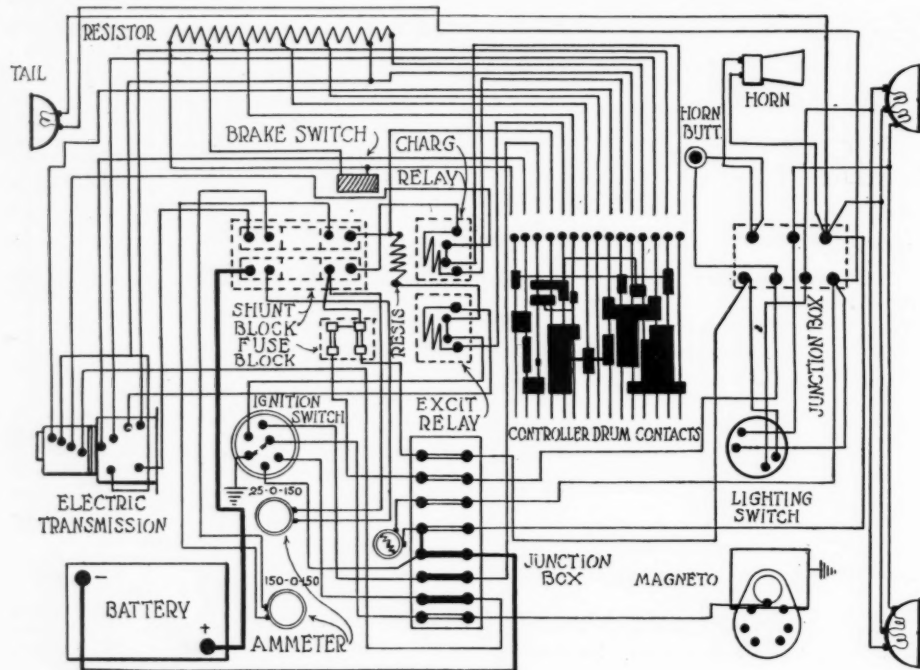


Fig. 13—Wiring diagram of Owen-Magnetic electric system

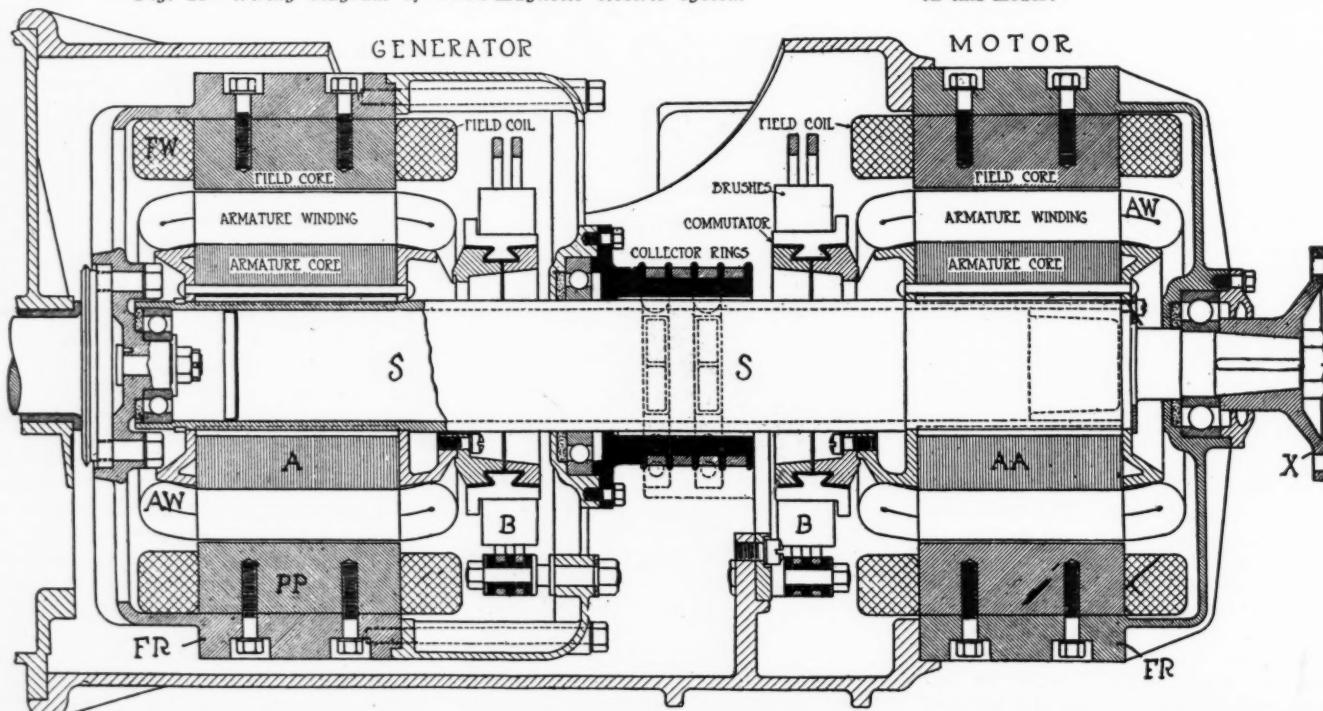


Fig. 14—Diagrammatic illustration of the two fields and two armatures of Owen-Magnetic

3—If so, do you think I could tell if they are offset in the new pistons. The engine had about the same kind of knock before reboring but did not knock at all when pulling or running, but since reboring it knocks and also when driving about 25 m.p.h. on level. If accelerated quickly, it can be heard, that is, while the car is idling.

4—Instruct how to take up main bearings.

5—How can I determine if there is any end play in the crankshaft or camshaft?—C. R. Johnston, Ashtabula, Ohio.

1—According to the drawings we have of the engine of your car the cylinders, pistons, and crankshaft are all on the same center line, so there will be no knock caused by reversing the position of the pistons, if the pistons fit the cylinder as well one way as they do the other. If the piston had worn itself to fit the cylinder in one position, it is very probable that reversing its position would allow it to knock. But since your cylinders have been reground and new pistons fitted, this possibility is eliminated.

If the knock is present when the engine is idling, it is possible it might be a piston slap. Test out the cylinders, one by one, by short-circuiting the spark plugs and then opening the priming cocks. If it is found that the noise disappears during this operation, you can be fairly certain it is a piston slap, indicating that the new piston was not fitted properly.

2—No.

3—See 1.

4—Main bearings can be taken up by removing the shims between the bearing cap and its upper half. Take out just enough shims so that the tightness between these bearings and the shaft will be noticeable when the flywheel is turned by hand, with the spark plugs out and the priming cocks open.

5—We would advise you to read the story on engine trouble appearing in the May 22 issue of MOTOR AGE.

This Hudson Engine Knocks

Q—Why does the engine of this Hudson knock on a pull?—G. R. Miller, Akron, Ohio.

There are several reasons why your engine will knock. We refer you to the May 22 issue of MOTOR AGE, in which appeared an article on engine knocks.

Concerning Alloy Pistons

Q—Giving grey iron pistons a credit of 100 percent efficiency as to strength, wear and possible breakage, how do some of the good alloy pistons compare on a percentage basis?

2—What increase in motor speed and power, all other things being equal, would be gained by using alloy rods and pistons?

3—Do not alloy rods bearing directly on crankshaft have tendency to expand at high temperatures, causing more or less noise and vibration?

4—Does not the expansion in alloy rods and pistons increase compression at high motor temperatures as reached?

5—Does aluminum expand more than babbit?

6—Would a crank shaft as small as on the Ford be weakened by drilling lengthwise through main and connecting rod bearings than drilling from center of bearing surface to center of shaft? Holes not to exceed 8/64 or 9/64. Would this aid lubrication and would the gain warrant the work?

7—Do not some of the aircraft motors use castor oil exclusively?—H. R. Bowton, 350 W. Knox St., Galesburg, Ill.

1—As now made there is no material difference. Up to a year or so ago this was not the case and the cast iron had the better of the argument, but great progress has been made in the formula of aluminum alloy and it is being improved all the time.

2—This would be hard to determine because there are too many factors to take into consideration, but it will not be denied that with these lighter reciprocating parts an engine would be much snappier and

show better speed and also less vibration.

3—We have never heard of this practice—of using the aluminum as bearings on the crankshaft; always there is some form of bearing metal, such as babbit or bronze.

4—The pistons themselves are not charged with making or holding compression; this is the duty and function of the rings. The pistons do not, theoretically, touch the cylinder walls so far as they have relation to compression. Alloy pistons must be given more clearance than cast iron due to the fact that expansion is greater.

5—Yes.

6—No, and this is not uncommon practice. Yes, it would be of material benefit in lubrication.

7—Yes. A large percentage of the fighting planes in Europe used castor oil for lubrication.

When National Engine Overheats

Q—The engine on my National Highway six heats up. I have boiled out the radiator, drained off the oil, set the spark ahead and ground the valves, and still it heats. The engine works fine and the pump works good, but there is one place in the radiator where the water does not circulate. Is there any remedy you can suggest?—T. C. Jenkins, Auburn, N. Y.

The remedy for this overheating condition is to have that one particular place in the radiator repaired. If forced circulation from a high-pressure hose will not dislodge the material in the radiator, then try a solvent. A weak solution of lye can be tried, but it should not be left in the radiator for any length of time, as the chemical action will destroy the radiator. If this does not remedy the trouble, it will be necessary to open that section of the radiator up. This can be done by heating with a blow-torch. When this section is opened up a strong jet of water can be forced directly into the passages. This undoubtedly will remove the foreign material. In resoldering the radiator should be tested for leaks, at a pressure of about 15 lb. This can be done by using a regular inner tube tire valve, connecting it to the water passage by a hose, and a regular tire pump can be used to increase the pressure.

Cut-Out On Engine

Q—We have a 1918 Ford which we use for a service car and to pull a trailer a great deal. Would a cut-out be of any benefit to the engine.

2—All the spark plugs fire, but No. 4 cylinder does not work. It has new valves and gets gas but will not hit.—Harley Oneal, Rankin, Ill.

1—There has been much discussion from time to time about the advantages or disadvantages of a cut-out in the exhaust line of an engine. It stands to reason that, theoretically at least, if the exhaust gases of an engine were led directly into the air without passing through a muffler all the possible engine power would be realized. Racing cars, for example, never use mufflers. But you must give the makers of mufflers credit for having evolved mufflers designed to overcome back pressure to a minimum, and in some cases the mufflers actually help to syphon out the exhaust gases from the exhaust pipe and, if anything, assist in getting rid of them quickly. So after all has been said and done you will get as good results without a cut-out as with one, provided you have an efficient muffler. Owners sometimes forget to clean out their mufflers, which when coated

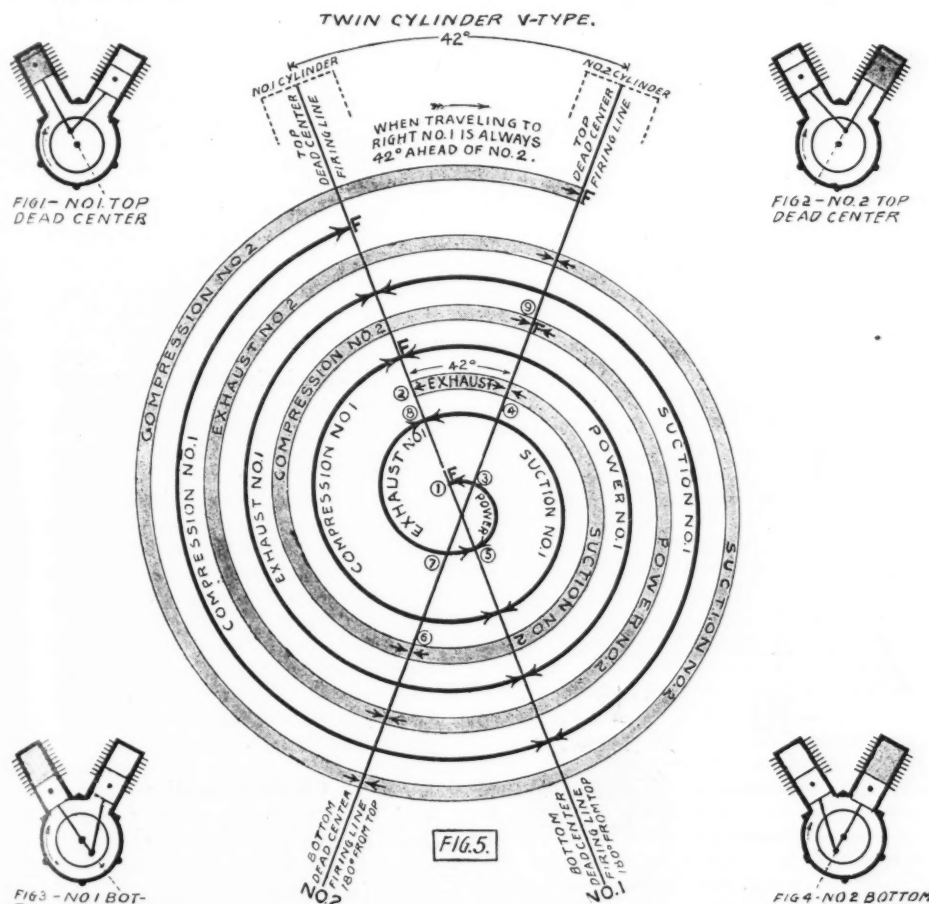


Fig. 15—Timing diagram of the Harley-Davidson motorcycle

on the inside with heavy layers of soot greatly impede the flow of exhaust gases and the engine loses much power. A cut-out comes in very handy when tuning an engine, for you can distinguish the explosions more clearly.

2—If you are sure the spark is getting to No. 4 cylinder and yet it does not fire, then the trouble must be in the valves or in the cylinder itself. For instance, the cylinder walls may be scored badly and have no compression. You can test the compression by turning the engine over slowly and noting the resistance of all the cylinders in turn. If there is a decided difference in No. 4 as compared with the others, you may be reasonably sure that lack of compression is your trouble. Loose piston rings or poorly fitted rings may be the cause, but before you do anything take off the valve cover plates and see if the stems on the intake and exhaust valve of No. 4 have sufficient clearance, but not too much. Too much clearance on the intake will let it open too late, and then you will not take in a sufficient charge of gas to ignite it always. See if you can get a thin visiting card between the stems and pushrods. If so the clearance is about right.

We are taking for granted that your spark is all right, but it may not do any harm to interchange the plugs and see if the last cylinder still misfires. If it does not, then obviously it is the plug you are using. Whatever cylinder you use the faulty plug in will misfire. Examine also the low-tension wires going to the timer; the one to No. 4 may be broken or loose. Also check up on the vibrator points of No. 4 coil.

Why Engine Rattles

Q—After driving a 1916 Buick roadster D-44 from 2200 to 3000 miles the bearings need taking up; otherwise there is a disagreeable pound or rattling noise. There is some end play to the crankshaft. Can this be causing any of the noise? Last fall I had the carbon burned out to see if that would improve or was the cause of it, but it did not change conditions in the least.

2—With 60 lb. of air in the tires the car rides as if it had solid tires 34 by 4. It is equipped with Gabriel Snubbers.

3—Could shims be soldered on the end of each main bearing to take up the end play of the crankshaft?—G. W. Aiken, Toledo, Ohio.

1—It is probable that the noise is caused by looseness in the overhead valves and rocker arms. It is possible that there is end play in the crankshaft, but if there is, it will not cause the engine to have a rattling sound. It would be of a thumping character, occurring regularly at engine speed.

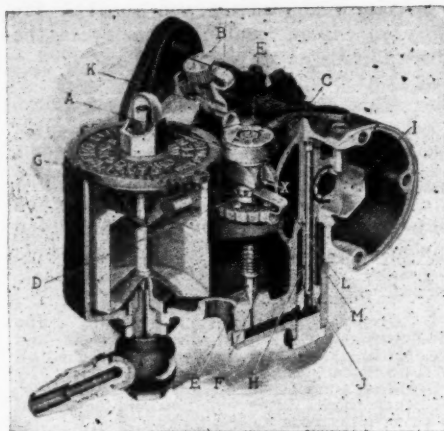


Fig. 17—Stromberg carburetor, with adjustments

2—If the springs on your car are well lubricated and the spring shackles have not been neglected, there is no reason why the car should ride hard; in fact, with 60 lb. of air in the tires the riding qualities of the car should be materially increased, for with 34 by 4 tires the inflation pressure should be closer to 80 lb. than 60.

3—There is no reason why shims attached to the bearings as you describe will not take up the end play.

Lapping in Patented Rings

Q—Publish instructions for lapping in patented piston rings. Is there any difference in lapping in patented and the ordinary type of ring? If so, what?—E. Sebens, Hamlet, Ind.

Generally speaking the patented form of piston ring does not need any lapping in. These rings are constructed so that they expand equally in all directions because they are composed of several pieces. Many of the patented rings need only to be installed carefully and after that the car should be run at moderate speeds and with plenty of oil in the engine for about 100 miles. This is generally considered sufficient to allow the rings to wear themselves in place.

Engine for 12 K.W.

Q—What would be the best kind of an engine that would pull a 12-k.w. dynamo with full load? I am using a Cadillac engine, 30 hp. brake test, and it can only pull about 60 amp. How would a big one-cylinder engine do with a throttle governor?—Henry Haverkamp, Kelly, Kan.

The equivalent of 12 kw. is 16.08 hp. If the Cadillac engine you are using is rated at 30 hp., there is no reason why the engine will not pull the generator.

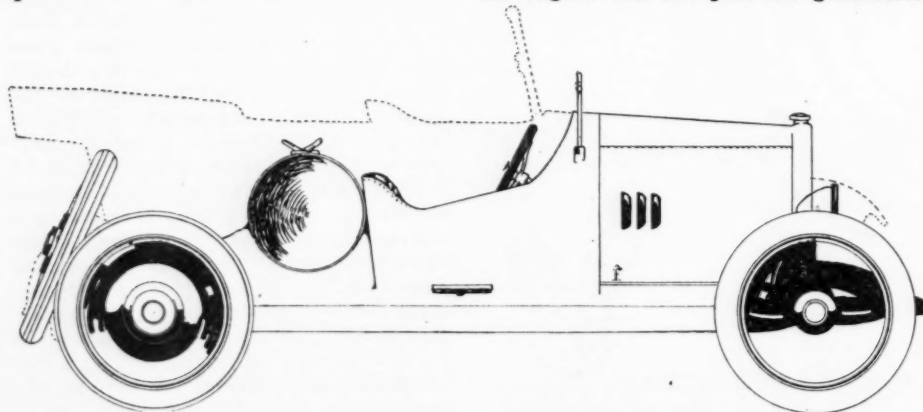


Fig. 16—Suggestion for converting 1912 Cadillac into speedster

You do not tell us how the engine is driving the generator. It might be that the speed of the engine is below its maximum horsepower speed, in which case you will not get the best results. The generator has a certain speed for its most efficient running position and so has the gasoline engine. If the engine develops sufficient power at a certain speed, then it is only a question of belting the engine to the generator at the correct speed ratio. We would not advise you to use a single-cylinder engine of about 20 hp.

Lubrication

Oil Gage on Velle

Q—How should the oil gage on the Velle 28 work?

2—Where can I get a clutch release collar for a cross-country Rambler?—Robert Biggs, Tiffin, Iowa.

1—The oil gage on the Velle 28 should register the pulsations of the pump. This is a low-pressure oiling system, and each stroke of the pump creates a pulsation in the oil line to the gage.

2—From the Nash Motor Co., Kenosha, Wis.

Lubrication of Stutz

Q—I have been advised to use a heavy grade of Monogram oil in a Stutz. Can this oil be mixed with castor oil, and what proportions of each? Would this be of any advantage? Where can I obtain castor oil?—James E. Boyes, Detroit.

The Stutz Motor Car Co. does not recommend mixing Monogram oil. They find that the best results are obtained by using the Monogram heavy grade of oil, made and sold by the New York Lubricating Co. Do not use castor oil in your Stutz engine.

Lubrication on E. M. F.

Walker, Iowa, Editor MOTOR AGE—I notice several motorists have trouble with the E. M. F. oiler. I have had considerable experience with this car and find that the filler cap must be very tight and using thin gasket. This is a vacuum oiler and must get no air except from feeder pipes to crank case. It would be very difficult to make the hole small enough as you suggest, and unless made extremely small the oil supply will be too heavy.—A. G. Gary, Walker, Iowa.

Willis-Knight Lubrication

Q—How does the oil get to the piston pins and to the rings in the cylinder head and sleeves in the 1916 Willis Knight?

2—Publish diagram of oiling system.—Robt. L. Boyer, Newman, Ill.

1—The crank pins and sleeve valves of the Willis-Knight engine are lubricated by the oil which is splashed from the connecting rods and the crankshaft. The sleeve valves have oil retaining grooves cut in them which serve to distribute the oil over the surface of the sleeve, this distribution is augmented by the holes which are cut in the sleeve.

2—This diagram was shown in the May 1 issue of MOTOR AGE.

Oil High on Olds

Q—I tried the remedy given in April 26th issue regarding oil trouble on my Olds Eight but it gave more oil, so I bored under the ring so the oil could drain back in the case, but with no results. This engine has just been rebored and new pistons fitted to same, also leakproof rings. The trouble is all on the left side of the engine looking from front of the car. What causes this?—H. Clay Penick, Bakersfield, Calif.

1—In the light of our experience with the eliminating of spark plug fouling due to the pistons pumping oil we cannot understand how and why a piston will pump more oil if the method which we suggested in our April 26th issue is properly done. The groove which is cut on the piston should not be very wide, $\frac{1}{8}$ in. being enough, making sure that the grooves are cut with the proper slant. The small holes which relieve the groove of the excess oil should not be larger than $\frac{1}{16}$ in.

The Oldsmobile engine was designed so that the cylinder block on the left side should receive no more oil than the block on the right side. It is possible that the oil level in your car is too high. This at least is the indication that your letter gives.

Carburetion

Carburetor Trouble on Grant

Q—What causes a Grant Six model K to spit and almost stop when going on level or down grade. Pulling up grade about 20 m.p.h. it will hit good. I cleaned the carburetor but it did not seem to help much.—Milo J. Yanecek, Walford, Iowa.

We believe a proper setting of the carburetor will remedy your trouble. The vacuum tank may be partly the cause. If you find that the proper carburetor adjustment will not remedy the trouble, then remove the top screws of the vacuum tank, lift out the float portion with its mechanism and allow it to soak in kerosene for a day or two. If any sediment has caused trouble here, this should fix it. For the proper carburetor adjustment, see answer to J. F. W. Lange, Rockport, Tex.

Adjusting Carburetor on Pullman

Q—A Stromberg carburetor on this 1916 Pullman sedan will flood on a cool day every time engine is stopped, and flood badly. No sign of flooding on a warm day at all. While it was flooding this morning I hit it a rap with my pliers and it stopped. I can see nothing wrong with it and to make sure overhauled it thoroughly last week.—J. F. W. Lange, Rockport, Tex.

There are three adjustments on this Stromberg carburetor: A, the main adjustment, controls the gasoline supply from the float chamber, regulates the mixture through the whole driving range and should be set so that the engine shows its best life and power. Turning nut A clockwise, or to the right, raises the needle and gives more gas; anti-clockwise, less. If an entirely new adjustment is necessary, turn nut A anti-clockwise, to the left, thus lowering the needle until it just seats—as shown by its sticking slightly when raised on lifting A—then turn A twenty-four notches clockwise, which should give a mixture somewhat rich. After starting and warming up the engine this adjustment may be regulated as necessary for the best driving mixture.

The gasoline for idling is taken in above the throttle and controlled by dilution with air from the inside of the carburetor, as regulated by screw B, which should be between one-half and one and one-half turns to the left, or anti-clockwise, from the seating position. After the engine is warm this may be regulated as necessary, turning to the right, or clockwise, for more gas, and to the left, or anti-clockwise, when less gas is required. Note the idling adjustment is effective only when the throttle is nearly closed.

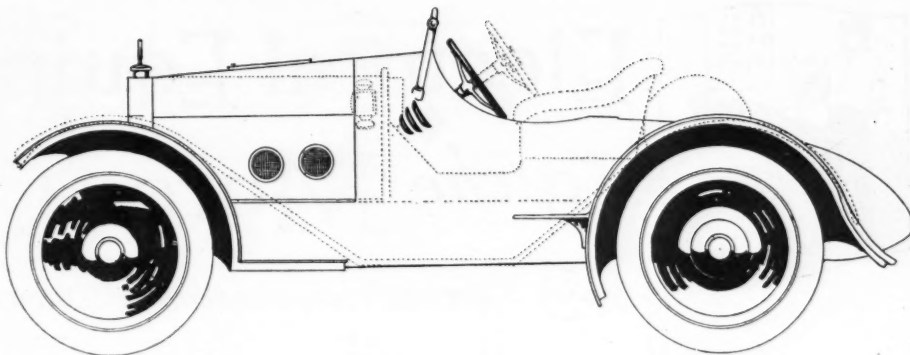


Fig. 18—Suggestion for speedster design on 1910 Hudson

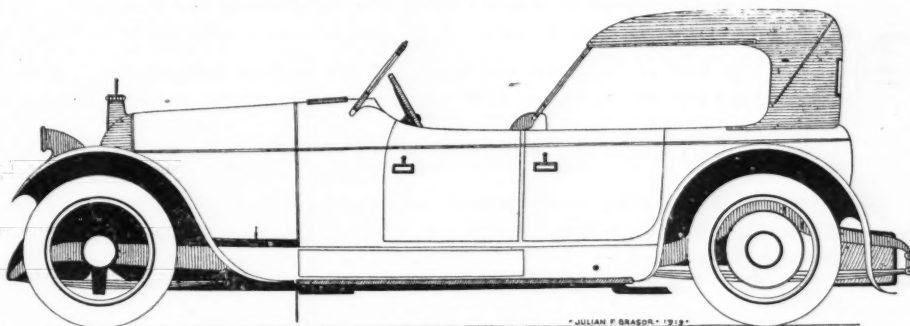


Fig. 19—Reader's idea for new body design for car with long wheelbase

As the throttle is opened it will be noticed that at closed and wide open positions the nut A and needle E are stationary, but at positions corresponding to speeds from 10 to 35 m.p.h. the needle drops so that C rests on D. This function is based on the fact that a richer mixture is required for full power and wide-open throttle than for closed throttle driving, when economy is the main consideration. The amount of this economizer action, or drop of the needle, depends upon the clearance shown at X and is controlled by the position of the pointer L, the extent of the action and consequent leanness of mixture increasing with the number of notches. To make this adjustment, retard the spark, open the throttle to about a 20-m.p.h. position, and set the pointer one notch less than the thinnest mixture on which the engine will run steadily when warm. This usually will be the third or fourth notch.

Rebuilding

Car Designed by Reader

The writer has endeavored to show by the accompanying illustration a new body design for the car with a long wheelbase. There are one or two examples of American cars with long wheelbases, that is, from 142 to 150 in., and in each case they are luxurious affairs. If a car is to carry seven passengers with genuine comfort and at the same time have lines of beauty and an air of luxury about it, the long wheelbase will be necessary to express the idea. The car here illustrated has a wheelbase of approximately 150 in. Note the low-hung horizontal chassis, the key to a luxurious body, the long flat heavy springs and the low-hung running-boards.

Note the large rounded radiator, the long gentle slope to the hood and the

deep cowl. The body, which is slightly lower, flows gracefully back from the curved cowl with long horizontal lines that only the extended wheelbase can give.

The upholstery is of the heavy arm-chair kind, thick backs and deep cushions which rest flat on the floor of the body. The spare seats fold into the back of the front seat on a sliding arrangement in the floor of the body. Note the graceful, oval one-piece fenders, especially how the rear ones are swept over the wheels, a feature which adds much to the appearance of the car. Also note the small lights on the front fenders.

This cannot help but show that there are many possibilities in open body design, especially in cars with long wheelbases, for the long horizontal lines add a touch of luxury unobtainable in any other design except the sedan.—Julian F. Brasor, Chicago.

1910 Hudson Into Speedster

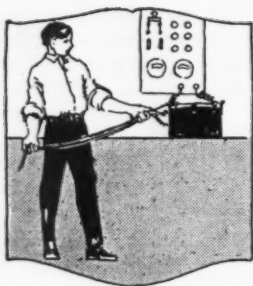
Q—Publish speedster design for model 20 1910 Hudson.—George Earnshaw, Jr., Youngstown, Ohio.

We do not advise rebuilding a 1910 model car into a speedster, but are showing a suggestion for a body in Fig. 18. A better plan we believe would be to sell the car, if it is in good running order, and then pick up a chassis of a more modern car on which you could mount a speedster body or doctor up the engine as you saw fit.

Cadillac Speedster Design

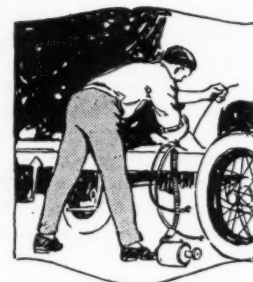
Q—Publish suggestion for design of snappy speedster made from a five-passenger 1912 Cadillac. Would like a comfortable third seat just at back of front ones, if possible. Have you a suggestion for a fourth side seat which possibly might be a drop seat?—S. H. Hobson, Rockford, Ill.

Our suggestion for this is shown in Fig. 16.



Electrical Equipment of the Motor Car

By David Penn Moreton & Darwin S. Hatch.



Editor's Note—Herewith is presented the 149th installment of a weekly series of articles began in MOTOR AGE, issue of June 29, 1916, designed to give the repairman and motorist the knowledge which will enable them to care for and repair any and all of the electrical features of the car, no matter what make or model it may be.

The first half of this series has been published in book form by the U. P. C. Book Co., Inc., 243-249 West Thirty-ninth street, New York, and is sold at \$2.50. The remainder of the series will be published as a supplementary volume.

Part CXLIX—Gray & Davis Systems

GENERATOR and starting motor actions are combined in a single-unit in all the different electrical systems for the motor car as manufactured by the U. S. Light & Heating Corp. The field structure of the unit is stationary, and the armature is fastened to the crankshaft of the engine in place of the flywheel. In some systems the armature rotates outside the field structure, while in the other systems the armature rotates inside the field as in ordinary practice.

Four principal types of equipment are supplied by the USL company, and these different types differ from each other chiefly in the method employed in regulating the output of the unit as a generator and the different combinations of voltages used in starting and charging.

An exploded view of the electrical unit for the 24-12-volt system is shown in Fig. 726, and a typical wiring diagram is given in Fig. 727. The battery used with this system consists of twelve cells divided into two groups of six cells each. These two groups are connected in series by the special rotary drum starting switch when the electrical unit operates as a starting motor and in parallel when the electrical unit is operating as a generator. In some installations the lights are operated direct from the two groups of cells in parallel or from a single group when the starting switch is depressed and they are of the 14-volt type. Some installations make use of a three-wire system for lighting, and in such cases the lamps are of the 7-volt type. Both of these systems of wiring are shown in the lower left-hand corner in Fig. 727.

The electrical unit is an eight-pole machine, and the fields are compound-wound. Both windings are used for generator and motor actions. The internal connections are plainly shown in Fig. 727. There are three terminals on top of the flywheel case.

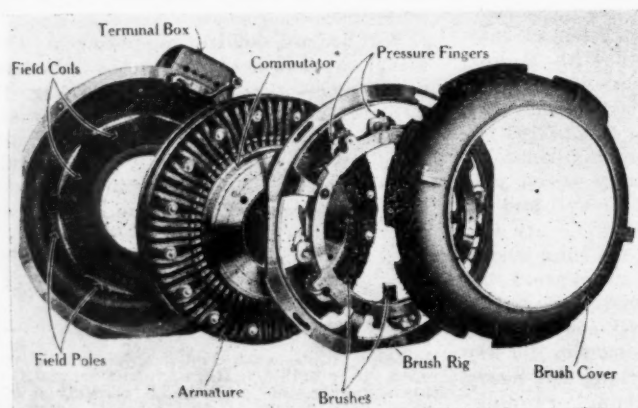


Fig. 726—USL 24-12 volt system, external regulator and external armature type

A diagram of the combined cutout and regulator is shown in the upper left-hand corner of Fig. 727. Both the cutout and regulator functions are taken care of by a single electromagnet, which has a shunt and series winding. The cutout contacts close and open the circuit connecting the generator and the battery in the usual manner. The regulator acts to vary the pressure on a small carbon resistance connected in series with the shunt field winding and thus varies the shunt excitation as the output changes.

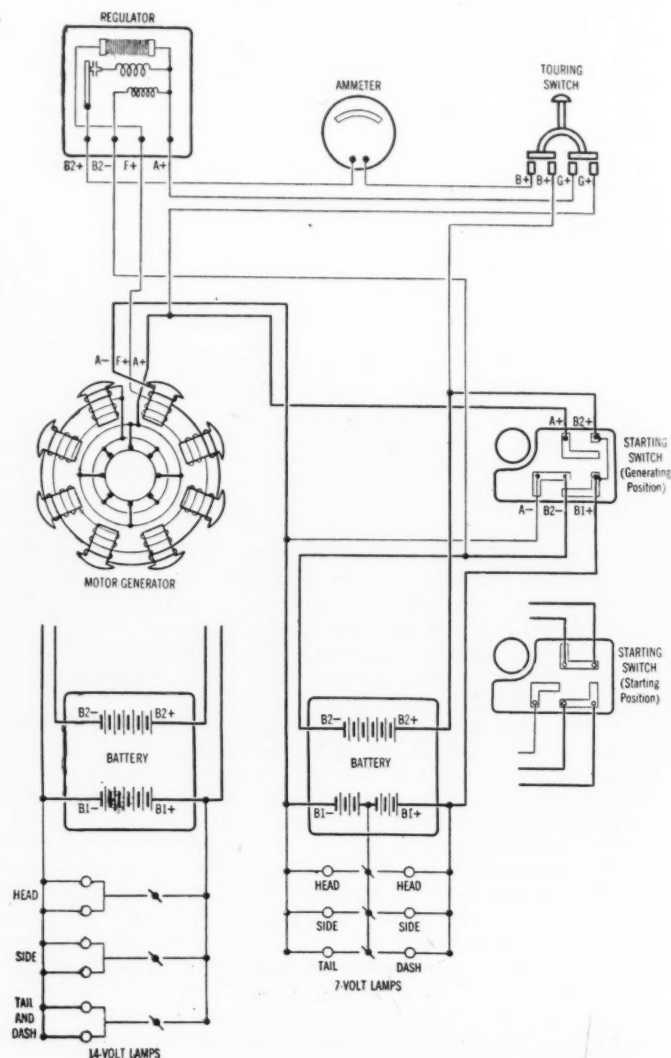


Fig. 727—Wiring diagram of the USL 24-12 volt system, external regulator and external armature type

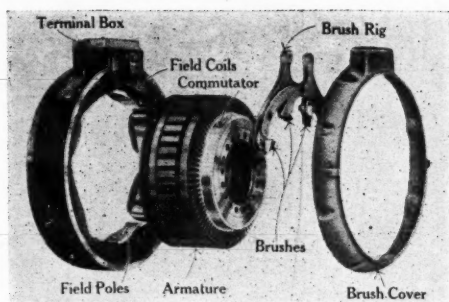


Fig. 728—USL 12-6 volt system, external regulator and internal armature type

The magnetizing action of the series field winding opposes the magnetizing action of the shunt field winding when the unit is acting as a generator and thus tends to prevent an excessive increase in the output of the machine.

The two positions of the starting switch are clearly shown in Fig. 727, and the starting motor and generator circuits easily may be traced by reference to this figure.

The touring switch shown in the upper right-hand corner of Fig. 727 enables the driver to control the charging of the battery. With this switch open the generator will not charge the battery, while with this switch closed the generator will charge the battery, provided the engine speed is sufficient.

12-6 Volt System, External Regulator

An exploded view of the electrical unit for the 12-6-volt system is shown in Fig. 728, and a typical wiring diagram is given in Fig. 729. The battery used with this system consists of six cells divided into two groups of three cells each. These two groups are connected in series by the special rotary drum starting switch when the electrical unit operates as a starting motor and in parallel when the electrical unit is operating as a generator. The lights are operated direct from one section of the battery, and they are of the 7-volt type.

Alternate poles of the electrical unit have a shunt winding, and the remaining poles have a series winding. The operation of the cutout, regulator, starting switch and touring switch all are the same as for the system described in the previous section.

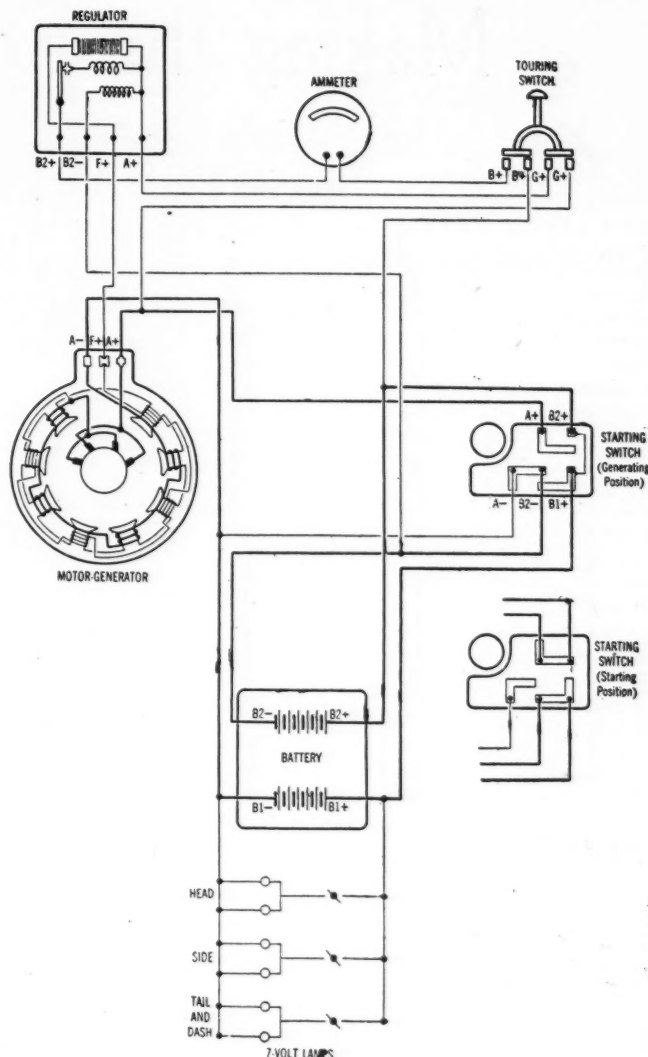


Fig. 729—Wiring diagram of the USL 12-6 volt system, external regulator and internal armature type

BOUR DAVIS IS AGAIN IN PRODUCTION

THE Bour Davis car which was announced several years ago again is being made. The Louisiana Motor Car Co., Inc., Shreveport, La., recently acquired the former interests of the Bour Davis Motor Car Co. and persuaded W. F. French who was connected with the Bour Davis Co. to take up the building of the car under the direction of the new company. The Louisiana Motor Car Co. now is making the L-M-C truck and the Bour Davis car, the latter having been under active production for three months.

The Bour Davis car is an assembled product, incorporating such standard parts as the Continental engine, Borg & Beck clutch, Muncie transmission and Salisbury rear axle. The wheelbase of the car is 118 in. and the approximate weight is 2900 lb. The Continental engine with its bore and stroke of $3\frac{1}{4}$ by $4\frac{1}{2}$ in. has an S.A.E. rating of 25.35 hp.

The equipment of the car is very complete, with Moto-Meter and dashlight mounted on a reel so that it may be used as a trouble light. The tool com-



The Bour Davis car, which will sell for \$1,595

partment is a drawer under the front seat, making it necessary to raise the front seat to get at the tools. The tonneau has special lights for convenience in getting in or out of the car. The

headlights have special dimming devices, small reflectors within the large reflector, for the small bulb. Also a rear view mirror is provided. Tires are 32 by 4, Goodyear. The car lists at \$1,595.

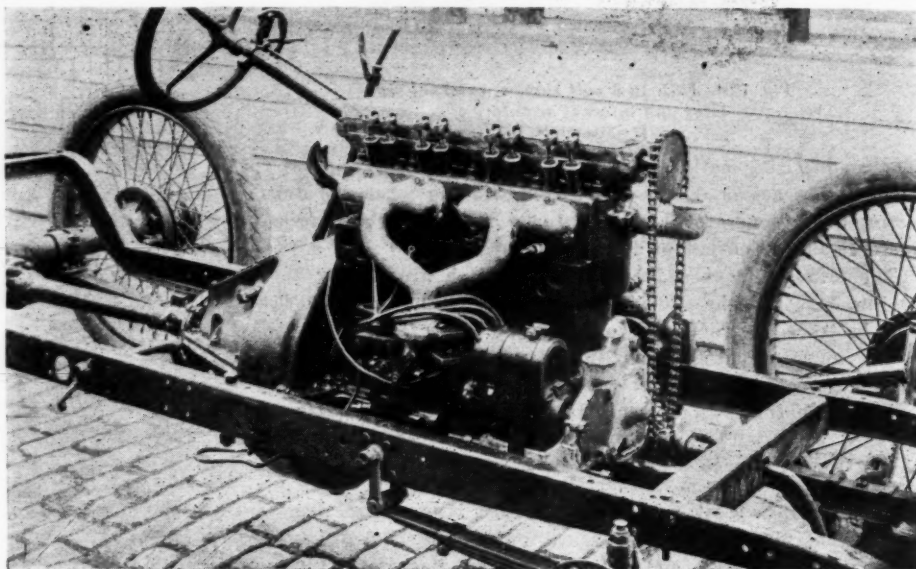
Making the Ford Fleet-Footed

Indianapolis Concern Has Sixteen-Valve Head and Special Fittings for Ford Speed Enthusiasts

RACING enthusiasts who select the Ford engine as the powerplant for their cars probably have found out by this time that increased valve and port area coupled with a correctly designed speed camshaft will aid more in increasing the volumetric efficiency of the engine than any other improvement that can be made. On this page are shown several illustrations of the Craig-Hunt sixteen-valve Peugeot type racing head for Fords. This head was designed for use on racing cars and speedsters where speed and power are the aim but Craig-Hunt, Inc., Indianapolis, Ind., who manufactures this head, does not recommend it on the touring car or truck. It is stated that a speed from 70 to better than 90 m. p. h. can be had with this head when properly installed. The maker points out that the use of this head increases the compression, doubles the valve area and at the same time lends the speed and power producing advantages of overhead valve construction without the use of heavy outside push rods. There are four valves for each cylinder, two intake and two exhaust, located overhead and seated at an angle of 20 deg.

The valves are $1\frac{1}{2}$ in. in diameter and operated by rocker arms of the forked type, in pairs. Each rocker arm is operated by the overhead camshaft which runs on three ball-bearings, all of which are inclosed in an oil tight aluminum housing. The cams are of the roller-follower type, each of which dips in oil and thereby lubricates the roller end of the rocker arm.

One of the features of this head is the use of two sets of plugs per cylinder. Each of these enters the combustion chamber below and between the valves on each side of the head. The camshaft is driven by a high-speed roller chain from a sprocket attached to the front end of the crankshaft in place of the fan pulley. No fan is used. The special intake manifold furnished with the head is flanged for either $1\frac{1}{2}$ or $1\frac{3}{4}$ in. carbureter. The head is amply water jacketed, each valve port being entirely surrounded by water to pre-



A Ford engine with sixteen-valve head and racing equipment set in a special frame

vent warping. Each outfit comes with special manifold, special stud bolts, chain, sprocket and gaskets. It can be placed on a Ford cylinder block in a short time without any machine work.

The head can be had for either standard or oversized cylinder block. Thus it will be possible for an owner to get an old cylinder block which will be well seasoned, have it reground and with the attachment of a sixteen-valve head secure a pretty fast racing job. One of the illustrations shows the Ford block installed in a special frame, with a high-tension magneto and racing carbureter. In this case the driveshaft has been shortened considerable and the engine moved back about 12 in. from the front axle.

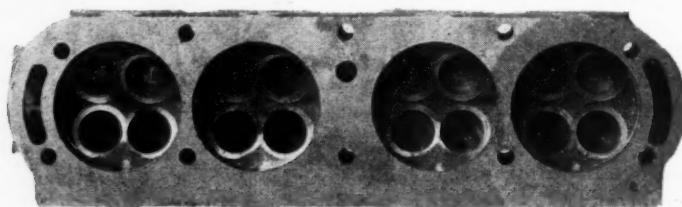
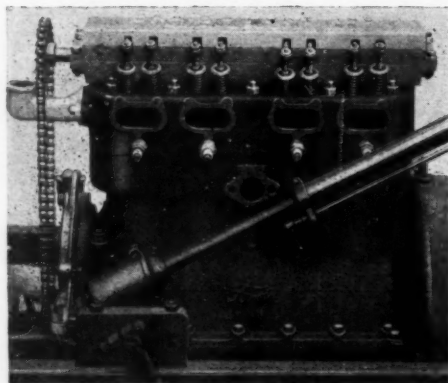
The Craig-Hunt company builds special Ford racing bodies, known as the Speedway racing body. These have a radiator shell of the new Fiat type fitting over the regular Ford radiator. The filler cap screws into place in a stock radiator, making it unnecessary to make any changes. The seats are 32 in. wide, deeply cushioned and fitted with long springs. The tail of the body is built after the French Peugeot torpedo design. It is formed over a canoe type wood frame, which is designed to enable the use of the Ford stock gasoline

tank. The apron or drop of the body is a permanent part of the latter and designed to give the car a lower appearance, covers the frame and assists in forming a more or less perfect streamline effect. The driver sits low, but has full vision ahead. The body is so designed that mounting it on a chassis has been simplified and requires but the tightening of six bolts. It is made of 21-gage metal.

For those who want to undersling the Ford frame this company furnishes brackets that greatly simplify the work. As the Ford chassis now stands it is too high for track racing and some sort of underslinging means must be resorted to. The price of the sixteen-valve Craig-Hunt complete is \$150, which is also the price of the Speedway body.

TONE GOES WITH WELLS

Fred I. Tone, former vice-president and chief engineer of the American Motors Co., Indianapolis, Ind., and later chief engineer of the United States Ball Bearing Co., is now with C. Harold Wills, former chief of the Ford Motor Co., who is making ready to enter the car manufacturing field in Detroit.



To the left is shown a Craig-Hunt sixteen-valve head on a Ford block, showing the exhaust ports and other details. Right, bottom view of head, showing the four-valve seats per cylinder

Liberty Camp Trailer Like a Small Cottage

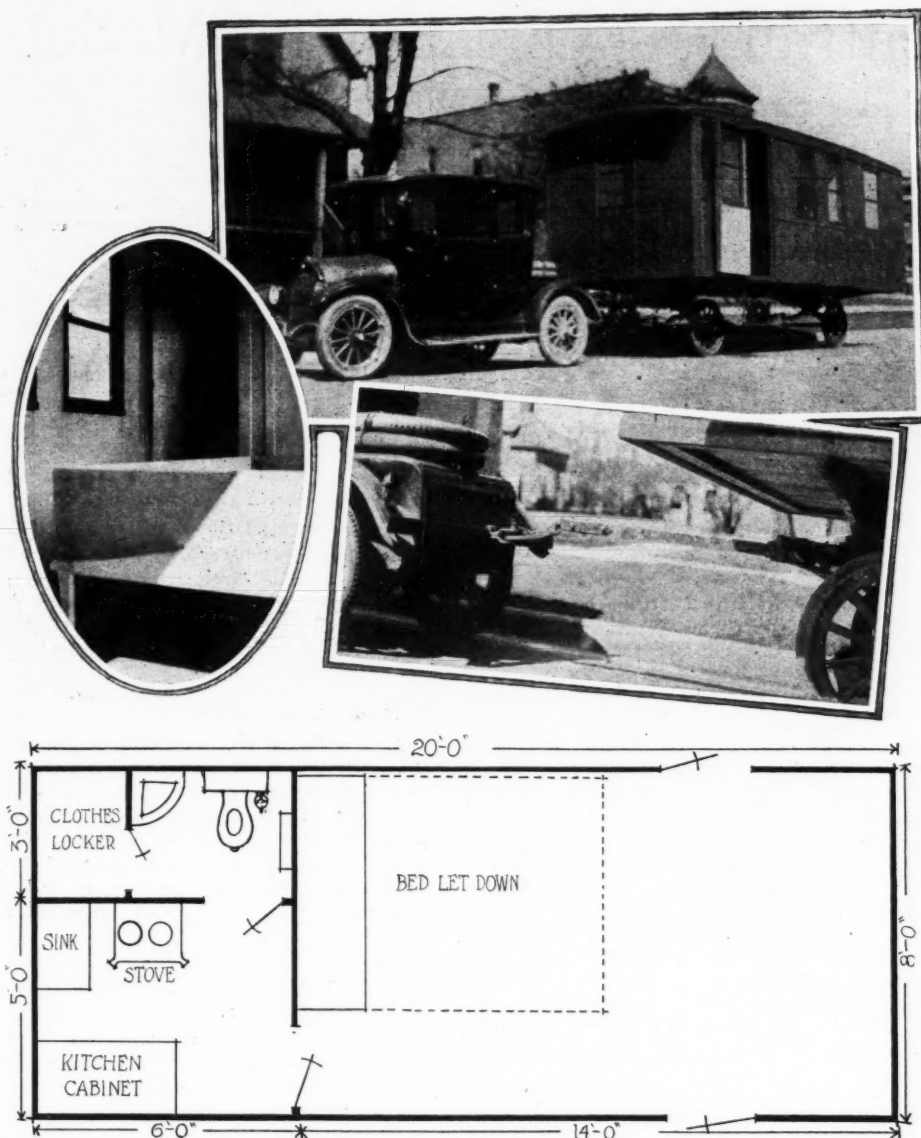
glass windows that drop in the frame, as well as windows in the doors. There is a door on each side with folding steps. Painting is optional, the interior being a light color with natural finish on the woodwork. There are four electric dome lights in the main compartment, two in the kitchenette and one in the lavatory, current being supplied by the battery in the towing car or a battery placed in the trailer, for which suitable connections are made. The trailer has a front and rear outside red light. All lights have individual switches.

In the main compartment is a folding bed equipped for box springs, folding table, chairs and folding cot, if desired. In the front part is plenty of space for trunks, talking machine, etc. In the kitchenette is a steel coal and wood cook stove, with a large oven, kitchen cabinet, sink with running water, ice box and fireless cooker. A tank below supplies the water, the latter being raised by Pullman pumps. The lavatory is completely equipped and has nickel-plated Pullman pumps for water. There is a large clothes press in the rear.

The weight and price of the outfit naturally varies with the size and equipment. It is stated the trailer easily can be pulled by a medium sized car, the illustration showing a small Overland coupe towing the 20-ft. size trailer. On a level one man can push the trailer. The running gear is of steel with solid square axles and platform type of springs. The wheels are artillery type with solid 30 by 3 in. tires and ball-bearing hubs.

DEALER TO MAKE TRUCK

Detroit, May 23—Leonard B. Orloff Co. has started the manufacture of a 1-ton truck bearing the name Detroit. The truck is made up almost exclusively of units turned out in Detroit factories. The engine is a Continental model N; the frame is from the shops of the Detroit Pressed Steel Co.; the springs from the Detroit Steel Products; the front axle is Timken and the rear, Russel; the clutch and transmission from the Detroit Gear & Machine Co.; the radiator is made by the Long Mfg. Co.; the steering is Gemmer; the wheels are made by the Hayes plants; the fenders and hood, Motor Metal Products.



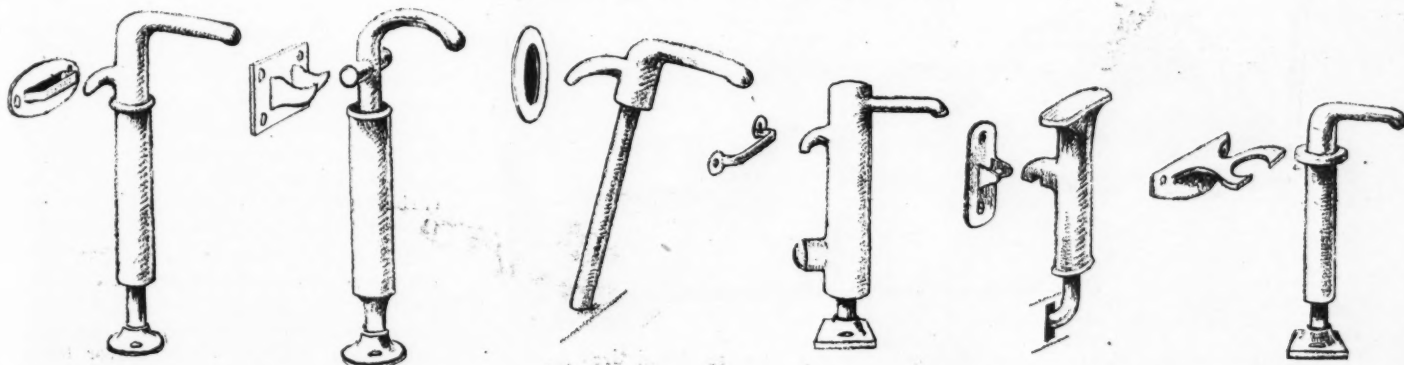
Three views of the Liberty camp car and the plan of its design

THE Liberty camp trailer shown herewith is practically a small cottage on wheels. It combines many of the improvements of the modern home into a small unit, that can be used alike by tourist, traveling salesman, moving picture concerns, in fact, by all who either from the standpoint of business or pleasure find it necessary to travel over country roads. It is made by the Liberty Camp Car Co., Chicago, and comes in two sizes, the one shown being 20 ft. long and 8 ft. wide. The

smaller size is 16 by 7 ft. Special styles will be built to meet individual needs and if desired the body can be mounted on a passenger car or truck chassis. Or, the rear of the towing car can be fitted with a fifth-wheel type of construction, making the trailer a two-wheeled job.

The frame of the body is of hickory, oak and elm; the outside being covered with thin sheet steel and the inside lined with plaster board, resulting in a light, dry and warm construction. There are ten plate

Some Ideas in Hood Fasteners



Gray to Concentrate on One Engine Model

New Four-Cylinder Embodies Features Which Add to Economy and Power

THE new model of the Gray Motor Co., Detroit, is the only type that the company is making, all other models having been abandoned to concentrate on this one four-cylinder job. The engine has overhead valves, is cast in block and is thermosiphon cooled. Its bore and stroke is $3\frac{1}{2}$ by 5 in., giving it an S. A. E. rating of 19.6 hp.

The engine has several unusual features which add to its economy and power. One of these features is the two hot-spots internally in the cylinder head, where the intake passage passes the exhaust passage inside the head, so the intake passage walls are heated by exhaust passage on top as

well as on the bottom, by the explosion chamber. This arrangement is said to give exceptionally high efficiency and economy in the use of the present low-grade fuel. The cylinders are cast in block, with the upper half of the crankcase. As the cylinder heads are separate from the cylinder block, it is possible to completely machine the compression spaces, and thus insure uniform compression in all cylinders. The cylinder bores are ground to size, and the cylinders are offset from the crankshaft axis to reduce the side thrust of the pistons against the cylinder walls. Inlet and exhaust passages are cored in the cylinder head. The bottom half of the crankcase

is made of cast iron for truck and tractor engines and of aluminum for car engines.

Both sets of valves are interchangeable, and to permit of making them of large sizes the cylinders are counter-bored from the top end. The effective diameter of each valve is $1\frac{1}{2}$ in. The valves have carbon steel stems and cast-iron heads, the latter of $2\frac{1}{4}$ in. outside diameter. The pistons are of conventional design, of cast iron, provided with three diagonally split expansion rings each. The connecting-rods are I-section drop forgings.

The crankshaft is supported in three bronze back bushings, all 2 in. in diameter, and of the following lengths: Front to rear, $2\frac{3}{4}$ in., 2 in., $3\frac{3}{8}$ in. The bearing caps are made of malleable iron, with laminated shims between the caps and the upper half of the bearing.

Three-Bearing Camshaft

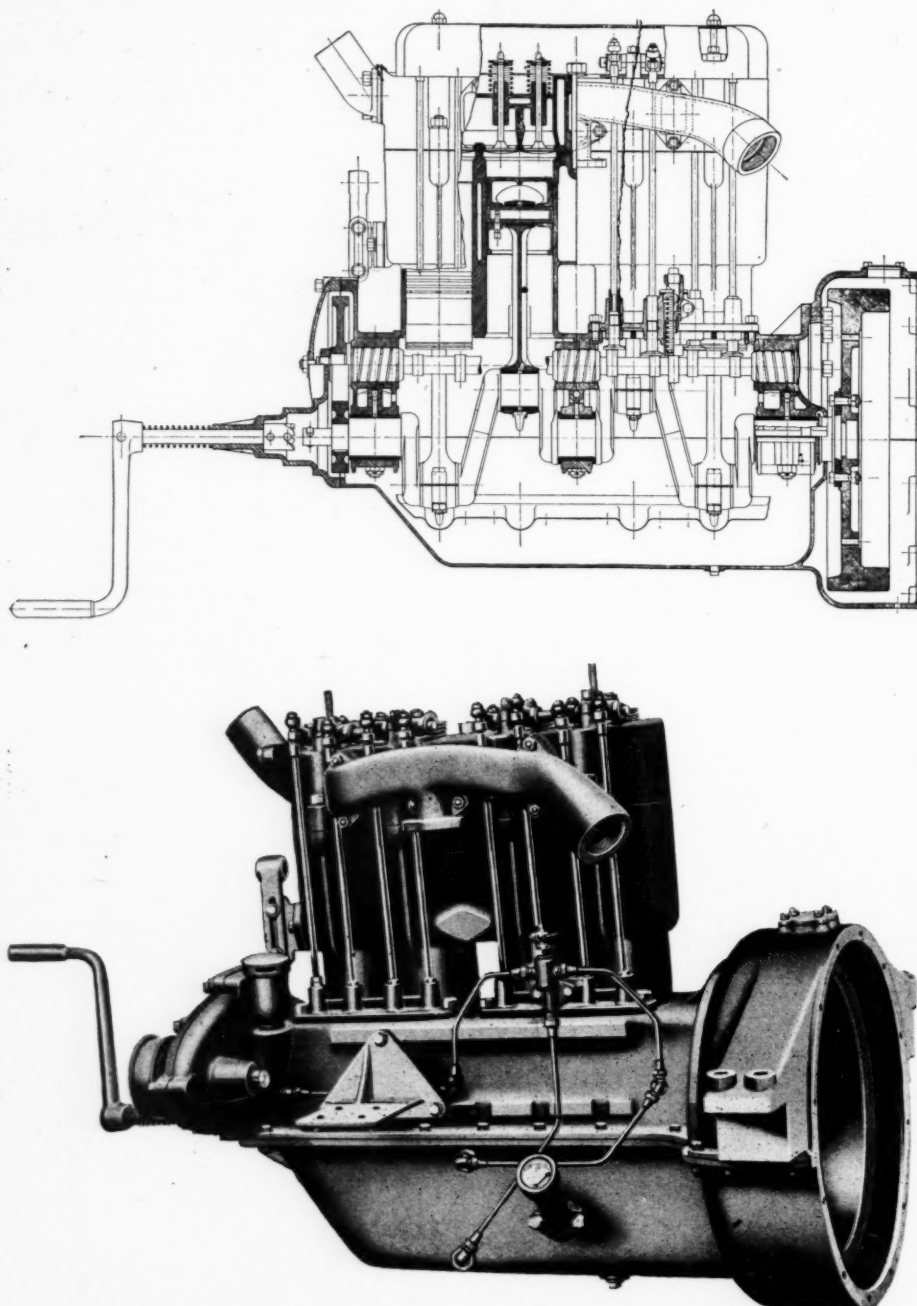
A three-bearing camshaft is used. This shaft is $1\frac{1}{8}$ in. in diameter and has its bearings directly on the cast iron of the cylinder block. Helical toothed gears drive the camshaft. The pinion of the crankshaft and the magneto driving gear are of steel, while the gear on the camshaft is made of cast iron. The timing gears are inclosed by a malleable iron cover, the hub on which for the crankshaft is turned off cylindrically to form the third point of support for the engine.

Oil is fed to the three main crankshaft bearings under pressure by a plunger pump operated from an eccentric on the camshaft. The plunger of this pump, instead of moving in a horizontal plane, has an up and down motion. In addition to supplying oil to the main crankshaft bearings, oil is delivered from this pump to the timing gears and to the connecting-rod splash troughs. All other interior parts, including the camshaft bearings, pistons, connecting-rod bearings and cylinders, are lubricated by splash. Oil is drawn from the main oil base through a fine mesh screen. The base will hold 5 qt. of oil and is provided with a positive dial indicator showing the oil level. As a precautionary measure, when the gage shows "empty" there is still a certain amount of oil in the base.

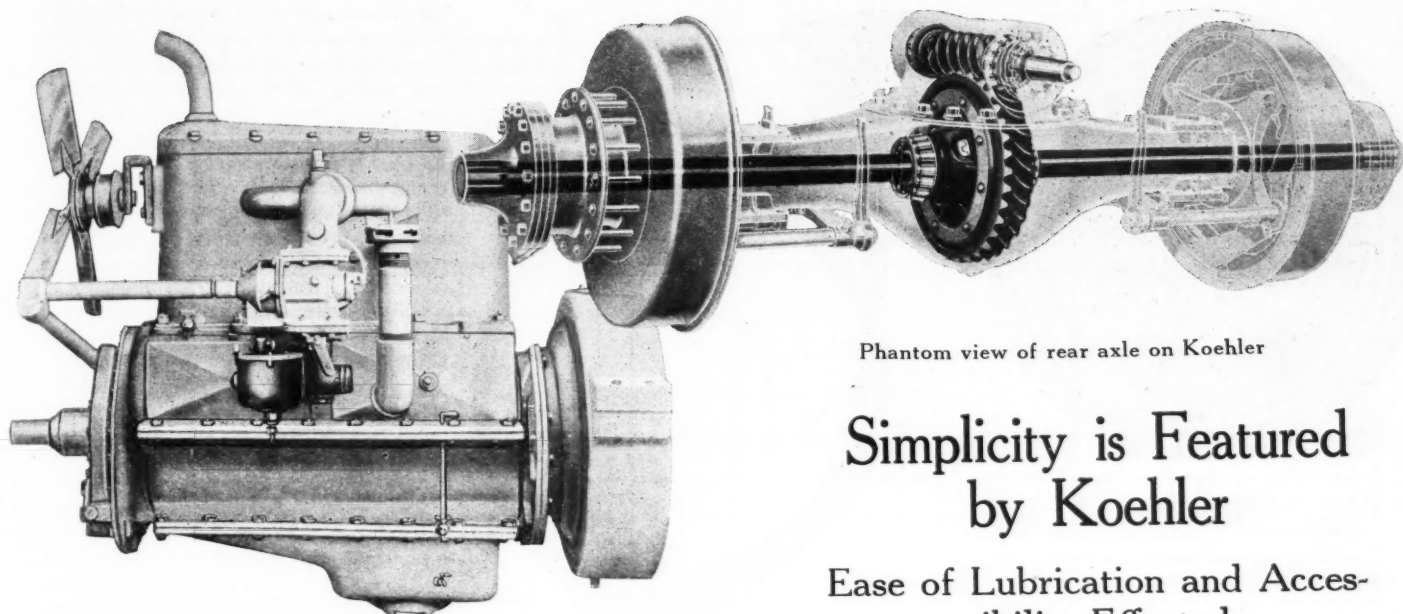
Standard Carburetor Used

The engine is designed to take a standard 1-in. carburetor. A horizontal or a vertical outlet carburetor can be used, the vertical outlet type going on the left side and fastening to the inlet manifold, while the horizontal-outlet type is placed on the right side and connects directly to the cylinder block. With the horizontal type carburetor the intake passage leads through the space between cylinders Nos. 2 and 3.

A starting motor flange is provided on the detachable bell housing. An ignition generator or plain lighting generator, a magneto or both can be mounted on the detachable magneto or generator bracket



Side views of new Gray engine, showing above a cross-sectional drawing



Engine used in Koehler 2 1/2-ton truck

Phantom view of rear axle on Koehler

Simplicity is Featured by Koehler

Ease of Lubrication and Accessibility Effected

and can be driven by a standard two-bearing magneto shaft and coupling. A bell housing of cast iron is furnished for truck and tractor work and of aluminum for car work.

WILL STUDY SHORT HAULS

Washington, May 30—The Highways Transport Committee, Council of National Defense, will make an intensive study of short haul problems at Boston, New York, Philadelphia, Pittsburgh, Baltimore, Washington, Atlanta, New Orleans, St. Louis, Chicago, Detroit, Cleveland, Omaha, Denver, Dallas, San Francisco, Los Angeles, Portland and St. Paul. The survey will be as complete as possible and the committee asks the co-operation of all manufacturers and dealers so it may secure the maximum amount of data. Any information relative to the names and addresses of operators, number and capacities of trucks in use, routes and schedules and rates with copy of the tariff when it is available, is desired. Such information should be sent directly to the Highways Transport Committee, Council of National Defense, Washington, D. C.

MEXICAN FORD MEN HELD

Detroit, May 30—The United States Immigration Department is badly muddling up the affairs of Henry Ford and his Mexican tractor plant, which he proposes to build soon in that country. Mr. Ford's picked delegation of Mexican workmen, which he was bringing to Detroit to take a course of instruction in tractor manufacture, has been held up at the border and will not be permitted to enter United States until Mr. Ford puts up a bond of \$500 for each man.

There are fifty Mexicans in the party, all of them recommended as specially adapted for manufacturing by the Mexican government. It is Mr. Ford's idea to make shop superintendents, department heads and foremen out of them, and he has arranged for a school at his Dearborn plant. He refuses to pay the bond required and has appealed to Washington.

THE Koehler 2 1/2-tonner is a fine example of truck engineering, accessibility and ease of lubrication having been worked out to literal simplicity. The chassis includes standard units such as the Koehler-Hercules engine, Zenith carburetor, Eise-mann magneto, Simplex governor, Brown-Lipe clutch, Brown-Lipe gearset, Spicer universal joints, Timken-David-Brown worm-drive axle, Parish & Bingham frame, Mather springs, Lavine steering gear and Wayne wheels.

The engine of the truck is cast in block and has four cylinders, the bore and stroke being 4 by 5 1/2 in. It is suspended in the chassis at three points. The cylinder head is detachable, as are the side plates. These uncover the whole left side of the crankcase, exposing the bearing adjustment nuts without removing the bottom pan. The valve tappets are held in pairs and made easily removable by the crow foot attachment which holds the tappets in pairs of two. The crankshaft is of five-bearing construction. Engine lubrication is by a force-feed gear pump, driven from the front end of the crankshaft. Oil is led to the main bearings through separate leads, and from there through the hollow shaft to the crankpin bearings.

The clutch is a ten-plate dry-disk unit, completely inclosed. The clutch is easily removed by taking out the screws holding the housing to the engine and disconnecting the flexible joint. The transmission is carried amidships and suspended at three points. It has four speeds and provision is made for a power take-off at forward

end of the housing for driving a winch or body hoist.

The rear axle is of the floating type. The worm wheel of the drive is splined on the inner side, making a very strong connection between the differential spider and gear. The gear is retained between two riveted flanges, serving to keep it from sliding off the spider. The brake hubs are riveted to the axle housing, are of the expanding type for the emergency and the service.

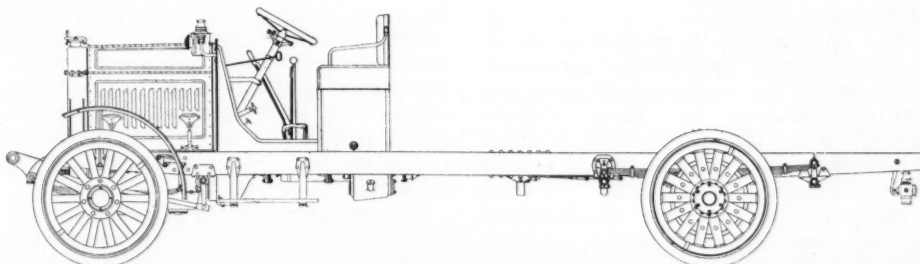
An unusual feature of the truck is the frame, rigid at the forward end to relieve the engine from any undue strains and flexible at the rear end. All spring shackles are attached to the frame so they do not project beyond the hangars. There are no projecting lubrication attachments fitted to the hangars, oiling being taken care of by special wick feed.

TRUCK EXPEDITION POSTPONED

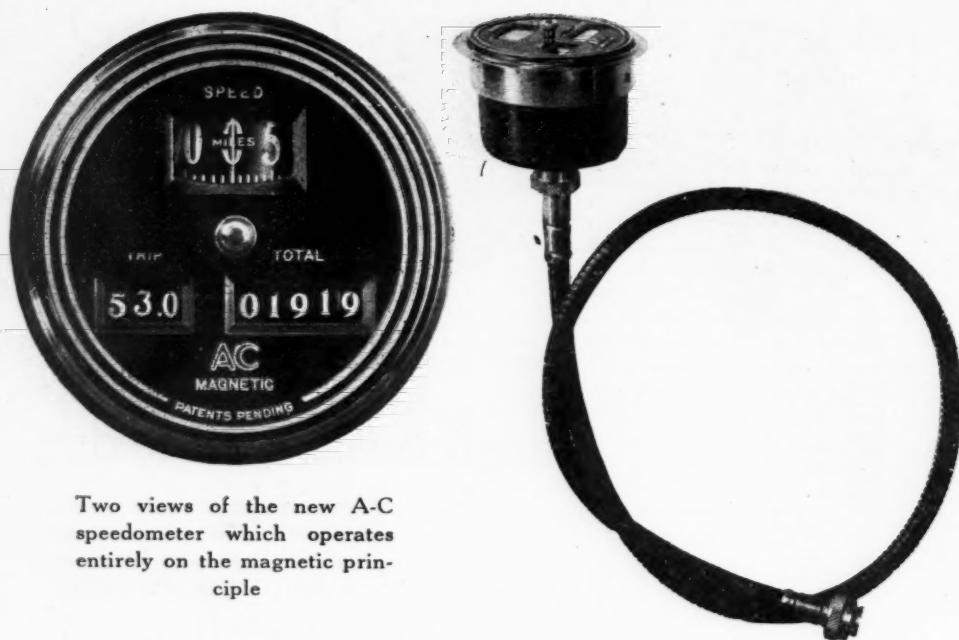
St. Louis, Mo., May 30—Because of the rainy weather and a desire for more time in which to complete arrangements, the St. Louis Motor Truck Expedition, which was to leave June 2 for a tour of Missouri and Illinois, has been postponed one week.

WICHITA TRACTOR DATE SET

Chicago, May 31—The tractor demonstration committee of the National Implement & Vehicle Association has definitely changed the date of holding the national demonstration at Wichita from the week of July 21 to the week previous—the week of July 14.



Side view of Koehler 2 1/2-ton truck



Two views of the new A-C speedometer which operates entirely on the magnetic principle

A-C Speedometer Now On Market

Magnetic Type Featured by Simplicity

THE A-C speedometer brought out by the Champion Ignition Co., Flint, Mich., is a magnetic type of marked simplicity, with an ingenious method for regulating and maintaining accuracy in spite of variations in temperature conditions. The speedometer operates entirely on the magnetic principle, having a stationary permanent horseshoe magnet held securely in the interior of the instrument in a manner similar to magnet and galvanometer construction. The magnet is stationary and the armature rotates within it, being driven by the flexible shaft connected with the driving mechanism of the car. The armature revolves in the magnetic field between the poles of the horseshoe magnet, the magnet poles being ground to receive it.

Segmented Armature

The armature is segmented into poles, the magnetic current passing through them and thrown or shunted in the direction of rotation carrying with it a non-magnetic element in the form of an inverted aluminum cup having on its periphery the scale which indicates the velocity of the vehicle either in miles or kilometers per hour. The light weight of the aluminum cup renders it so sensitive to the magnetic drag that the instrument starts to register at a speed of 1 m.p.h.

The speedometer is graduated up to 75 m.p.h., with graduations indicating every mile. The indicating element is a hairline crossing the glass window through which the speed is read in much the same way as the hairline on a slide rule indicator.

Objections to magnetic speedometers in the past generally have centered around the fact that the magnet expands in warm weather, thereby removing cold

to a greater distance from the armature. This slight variation is compensated for in the A-C instrument by an automatic thermostatic control which changes the relation of the armature lamentsations one to the other, thereby advancing or retarding the magnetic flux as may be necessary. In this way the speedometer will give correct reading regardless of the temperature conditions. There is an adjusting screw for making the primary setting on the magnet, and this is set at the factory and then sealed so that it cannot be tampered with by the ordinary user to throw the speedometer out of adjustment.

The construction of the instrument is such that the speed recording elements are contained in half the housing and the odometer component in the other. The only connection between the two is a worm shaft which operates the odometer. The odometer will register mileage covered by the vehicle up to 100,000 miles and repeat on the total, which in this instrument is placed on the right side, it being considered more natural to read totals summed up to the right. The trip register which can be reset at will, either forward or backward, to any desired figure, is placed at the left. It registers in miles and tenths of miles to 100 and repeats, the tenth figure being the same color as the unit figure, but divided by a decimal point, just as it would be read in a touring guide book. The resetting knob is very much the same as the stem wind knob on a watch and it is quick in action requiring only a straight pull out, whereupon the reset may be made rapidly.

The two halves of the speedometer are assembled and united by a steel band forced over the broad flange surface of the instrument by pressure. The mov-

ing parts are fully jeweled, having two large jewels of sapphire and garnet. There are several design features which are unique in the instrument, a valuable point being the connection of the flexible shaft to the back so that it can be hidden completely from view in mounting on a car. The neck to receive the shaft is concentric with the instrument and has a $\frac{7}{8}$ -18 S. A. E. (spark plug) thread. The ferrules have a tapered fit, making alignment perfect.

The speedometer is held into the instrument board of the car by a patented band clamp having slots tapered so that when turned, projections go into the slots and cause a forward movement of the clamp, thereby securing it. It is locked by tightening a screw.

The flexible shaft runs at 168 r.p.m. at 10 m.p.h., varying directly with the velocity of the car, or in other words, 1008 revolutions at 60 m.p.h. The travel of 1008 revolutions per mile is the basis for figuring all gearing with which to drive it.

The instrument will be standard equipment on Buicks and other cars during the coming season.

M. & S. NOW POWRLOCK

Cleveland, Ohio, May 30—The M. & S. Corp., which recently moved here from Detroit, has changed the name of its product from the M. & S. differential to Powrlock, and has also changed its corporate name to the Powrlock Co. M. T. Walker, formerly vice-president and general manager of the Walker-Weiss Co., is president of the new concern. Other officers are: Sales manager, L. O. Haskins, factory manager, R. S. Townsend; chief engineer, R. H. Goodrich.

GRAND CENTRAL FOR EXHIBITS

New York, May 30—The Grand Central Palace will be used as a show place for all sorts of manufactured products when it is returned from service as a base hospital Sept. 30. The Merchants and Manufacturers Exchange will take it over as a commercial exhibit building, and plans for reconstruction of the interior to make it suitable for this purpose are under way. It is a twelve-story structure, each floor having approximately 60,000 sq. ft. of floor space. The four lower floors will continue to be used for annual expositions, and the eight upper floors will be divided among the industries for permanent showings of their products, to be opened Oct. 15. Some of the industries will occupy an entire floor, such as the International Farm Tractor and Implement Exchange, to occupy the sixth floor.

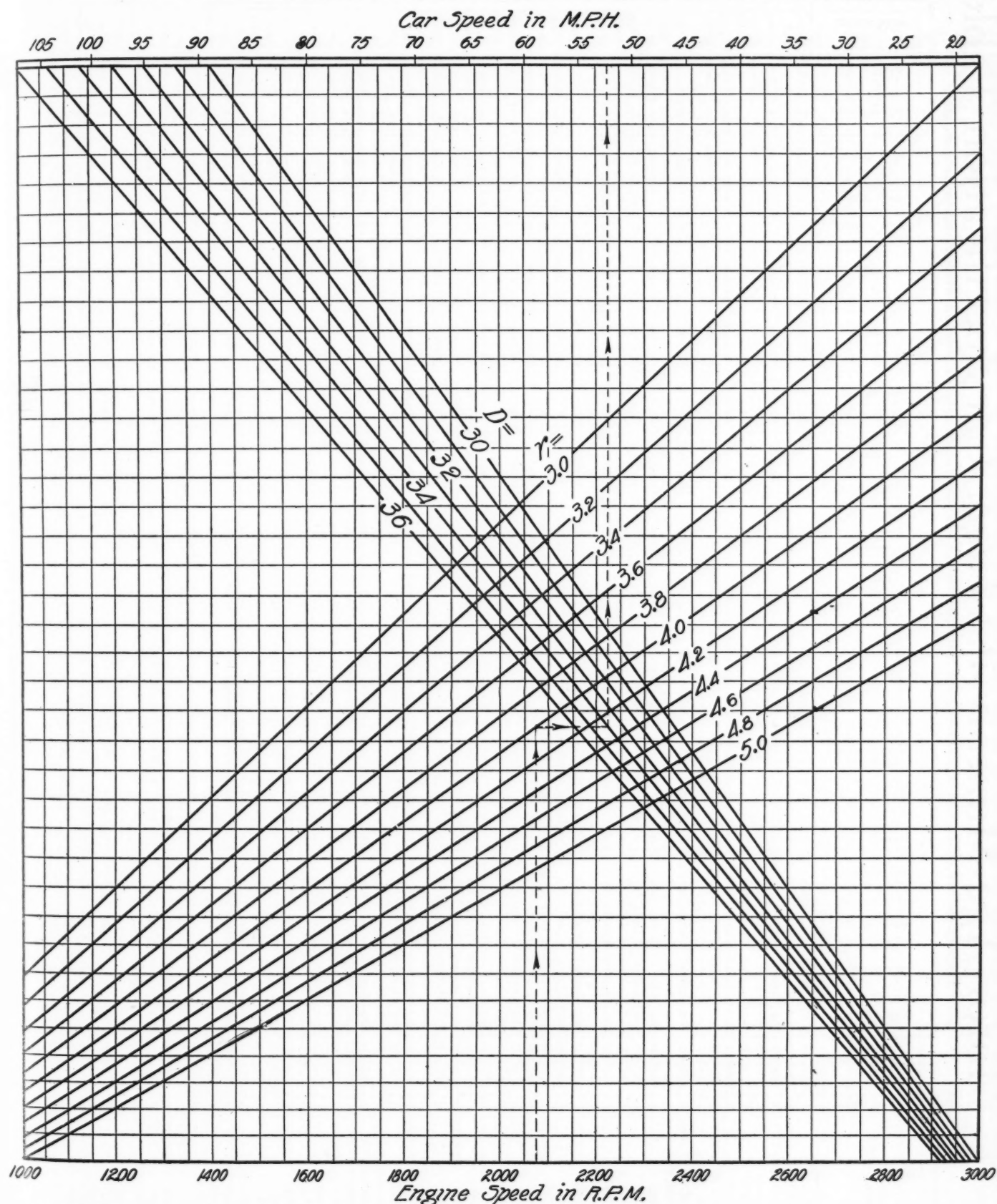
STEVENSON LEAVES BETHLEHEM

Allentown, Pa., May 30—W. S. Stevenson has resigned as general sales manager of the Bethlehem Motors Corp. on account of ill health. He had been general sales manager since the beginning of the company. Roy S. Davey, also with the company since its formation, succeeds him.

Engine and Car Speed Chart

Motor Age Maintenance Data Sheet No. 39

One of a series of weekly pages of information valuable to service man and dealer—Save this page



To find the car speed in miles per hour when engine speed in revolutions per minute, the high gear reduction ratio and the wheel diameter are known, locate the engine speed on the bottom scale, proceed up to the inclined line representing the reduction ratio, thence to the inclined line representing the wheel diameter and thence up to the top scale for the result.

Motor Age Monthly Passenger Car Specification Tables

These prices apply to five and seven-passenger models only—These tables are revised and brought up to date monthly

Name and Model	Seating Capacity	Price	Wheelbase	Rear Tire Size	Make of Tire	Bore and Stroke	Engine Make	No. Cylinders	N. A. C. C. H.P.	Carburetor	Make and Size	Fuel Feed	Clutch	Gearset	Universals	Rear Axle	Steering Gear	Speedometer	Rims	Battery Amp.	Battery Make	Generator Make	Motor Make	Ignition Make	Lamp Voltages	Name and Model	
Allen 41.....	5	\$1195	112	32x33	optional	3 1/2 x 5	Ow	4	22.50	1—Strom.	Vacuum	B. and B.	Ow	Arvac	Adams	Ditweiler	Stewart	Firestone	6	90	U. S. L.	A-L	West.	Conn.	6	Allen 41.
American B.....	7	1865	122	32x34	Firestone	3 1/2 x 5	Ruten.	6	23.44	1—Zen.	Vacuum	B. and B.	G-L	Arvac	.....	Salisbury	Gemmer	V. Sicken	Firestone	6	100	Col.	West.	A-K.	6	American B.
American Beauty 1.....	5	2000	121	33x34	optional	3 3/4 x 5	Ruten.	6	23.44	1 1/2—Ray.	Vacuum	B. and B.	Warner	Arvac	.....	Timken	Jacox	Warner	Firestone	6	100	Willard	G. & D.	Remy	6	American Beauty 1.
Anderson 400-A.....	7	1750	120	33x34	Federal	3 1/4 x 5 1/2	Cont.	6	25.35	1—Zen.	Vacuum	B. and B.	Durston	Arvac	.....	Col.	Warner	Stewart	Firestone	6	80	Willard	West.	Conn.	6	Anderson 400-A.
Apperson 8-18.....	7	4000	130	34x34	optional	3 1/2 x 5	Ow	8	33.80	John.	Vacuum	Ow	Ow	Sterling	.....	Ow	Ow	V. Sicken	Firestone	6	90	Willard	Bijor	Remy	6	Apperson 8-18.
Auburn 6-39-H.....	5	1595	120	33x34	Goodrich	3 1/2 x 4 1/2	Cont.	6	25.35	1—Ray.	Vacuum	B. and B.	G-L	Hart.	.....	Col.	Jacox	Stewart	Firestone	6	80	Willard	Remy	Remy	6	Auburn 6-39-H.
Austin 12.....	6	4250	142	34x34	Goodrich	2 3/4 x 5	Weid.	12	39.68	1 1/2—Strom.	Vacuum	Muncie	Ow	Spicer	.....	Austin	Lavine	Warner	Firestone	6	.....	Willard	Delco	Delco	6	Austin 12.
Biddle H.....	4	2750	121	32x34	optional	3 1/2 x 5 1/2	Buda	4	22.50	1 1/4—Zen.	Vacuum	Warner	Warner	Spicer	.....	American	Gemmer	Warner	.....	6	90	Willard	G. & D.	Eise.	6	Biddle H.
Bour-Davis, 18-B.....	5	1850	118	33x34	Goodyear	3 1/2 x 5 1/2	Cont.	6	29.4	1 1/4—Strom.	Vacuum	B. and B.	Detrol	Arvac	.....	Salisbury	Gemmer	Warner	Perman	6	103	Willard	Remy	Remy	6	Bour-Davis, 18-B
Brewster.....	5	7700	125	34x34	Kelly-S.	4 x 5 1/2	Ow	4	25.60	Zen.	Vacuum	Ow	Ow	Ow	.....	Ow	Ow	Stewart	Firestone	6	.....	U. S. L.	U. S. L.	Bosch	6	Brewster
Briscoe 4-24.....	5	885	104	30x33	optional	3 1/2 x 5 1/2	Ow	4	15.20	1—Buick	Gravity	Ow	Ow	Ow	.....	Ow	Ow	Stewart	Perl-Jack.	6	80	U. S. L.	A-L	Conn.	6	Briscoe 4-24.
Buick H-45.....	5	1495	118	33x34	Goodyear	3 1/2 x 4 1/2	Ow	6	27.34	Mar.	Vacuum	Ow	Ow	Ow	.....	Ow	Ow	Stewart	Ow	6	60	U. S. L.	Delco	Delco	.....	Buick H-45.
Buick H-49.....	7	1785	124	34x34	Goodyear	3 3/4 x 1/2	Ow	6	27.34	Mar.	Vacuum	Ow	Ow	Ow	.....	Ow	Ow	Stewart	Ow	6	60	U. S. L.	Delco	Delco	.....	Buick H-49.
Cadillac 57.....	7	3220	125	35x55	optional	3 1/2 x 5 1/2	Ow	8	31.25	1 1/2—Ow	Pressure	Ow	Ow	Spicer	.....	C-Timk.	Ow	V. Sicken	Kelsey	6	.....	Exide	Delco	Delco	6-3	Cadillac 57.
Campbell C-4.....	5	835	110	30x33	Goodyear	3 1/2 x 4	Cont.	6	24.03	Sund.	Vacuum	Muncie	Ow	G-L	Stanwell	.....	Salisbury	Ow	V. Sicken	Firestone	6	.....	Willard	A-K.	6	Campbell C-4.
Case U.....	7	125	125	35x44	Goodyear	3 1/2 x 5 1/2	Cont.	6	29.40	1 1/4—Ray.	Vacuum	B. and B.	Ow	G-L	Stanwell	.....	Col.	Jacox	Stewart	Stanwell	6	117 1/2	Willard	West.	6	Case U.
Chalmers 35-C.....	5	1565	117	32x34	optional	3 1/2 x 4 1/2	Ow	6	25.35	1 1/2—Strom.	Vacuum	Ow	Ow	Mechanics	.....	Timken	Ow	Stewart	Kelsey	6	93	Willard	West.	Remy.	6	Chalmers 35-C.
Champion, C-4.....	5	116	116	33x34	Goodyear	3 1/2 x 4 1/2	Ow	23.4	1—Carter	1—Carter	Vacuum	Ow	Ow	Mechanics	.....	Peru	Ow	Stewart	.....	6	.....	Willard	Dyneto	Delco	6	Champion, C-4
Champion, C-6.....	5	116	116	32x33	Goodyear	3 1/2 x 5	Ow	19.6	1—Carter	1—Carter	Vacuum	Ow	Ow	Mechanics	.....	Peru	Ow	Stewart	.....	6	.....	Willard	Dyneto	Delco	6	Champion, C-6
Chandler.....	7	1795	123	34x34	Goodyear	3 1/2 x 5	Ow	6	29.40	1 1/4—Ray.	Vacuum	B. and B.	Ow	Ow	.....	Ow	Ow	Stewart	Firestone	6	100	Willard	West.	Bosch	6	Chandler.
Chevrolet 4-90.....	5	735	102	30x33	Goodyear	3 1/2 x 4	Ow	4	21.76	1 1/2—Zen.	Gravity	Ow	Ow	Ow	.....	Ow	Ow	Stewart	Perl-Jack.	6	.....	Prent.	A-L.	Will.	6	Chevrolet 4-90.
Chevrolet F.A. 5 and 2	5	1045	108	32x33	Goodyear	3 1/2 x 5 1/2	Ow	4	21.76	1 1/2—Zen.	Vacuum	Ow	Ow	Ow	.....	Ow	Ow	Stewart	Perl-Jack.	6	.....	Willard	A-L.	Will.	6	Chevrolet F.A. 5 and 2
Chevrolet F.B.....	5	1135	110	33x34	Goodyear	3 1/2 x 5 1/2	Ow	4	21.76	1 1/2—Zen.	Vacuum	Ow	Ow	Warner	Arvac	Ow	Warner	Stewart	Perl-Jack.	6	Willard	A-L.	Will.	6	Chevrolet F.B
Cole Aero Eight 870.....	7	2595	127	33x35	Goodyear	3 1/2 x 4 1/2	North.	8	39.20	1 1/2—Strom.	Vacuum	North.	Ow	Ow	Spicer	.....	Col.	Gemmer	Stewart	Stewart	6	50	Prent.	Delco	6	Cole Aero Eight 870.
Columbia CD and CS.....	5	115	115	32x34	Firestone	3 1/2 x 4 1/2	Cont.	6	25.35	1—Strom.	Vacuum	B. and B.	Ow	Ow	Spicer	.....	Timken	Gemmer	Stewart	Firestone	6	80	Prent.	W-L.	6	Columbia CD & CS.
Comet C-51.....	5	1685	125	33x34	Goodyear	3 1/2 x 5 1/2	Cont.	6	29.40	1 1/4—Ray.	Vacuum	B. and B.	Ow	Ow	Muncie	Col.	C. A. S.	Stewart	Firestone	6	75	Willard	Dyn.	Delco	6	Comet C-51.
Commonwealth 4-40.....	5	1195	115	32x33	Goodyear	3 1/2 x 5	Ow	4	19.60	1—Strom.	Vacuum	Mechanics	Ow	Ow	Mechanics	Peru	Ditweiler	V. Sicken	Stanwell	6	80	Willard	Dyn.	A-K.	6	Commonwealth 4-40.
Commonwealth 6-50.....	5	1495	118	32x34	Goodyear	3 1/2 x 4 1/2	Cont.	6	25.35	Tillot.	Vacuum	B. and B.	Ow	Ow	Mechanics	Columbia	C. A. S.	Stewart	Stanwell	6	90	Willard	Dyn.	A-K.	6	Commonwealth 6-50.
Crow-Elkhart K-36.....	5	1075	115	32x33	Goodyear	3 1/2 x 5	Gray	4	19.60	1—Zen.	Vacuum	B. and B.	Ow	Ow	Covert	Peru	Ditweiler	V. Sicken	Stanwell	6	100	Willard	Dyn.	Wagner	6	Crow-Elkhart K-36.
Crow-Elkhart K-46.....	5	1231	116	32x33	Firestone	3 1/2 x 5	Reuten.	4	19.60	1—Zen.	Vacuum	B. and B.	Ow	Ow	Covert	Peru	Ditweiler	V. Sicken	Stanwell	6	100	Willard	Dyn.	A-K.	6	Crow-Elkhart K-46.
Cunningham V-3.....	7	4250	122	35x55	optional	3 1/2 x 5	Ow	8	45.00	1 1/2—Strom.	Vacuum	B-L	Ow	Ow	Spicer	Timken	Gemmer	Warner	Firestone	6	120	Willard	West.	Delco	6	Cunningham V-3.
Danville B.....	7	3750	127	34x34	optional	3 1/2 x 5	H-S	8	33.80	1—Zen.	Vacuum	B-L	Ow	Ow	Spicer	Timken	Gemmer	Stewart	Firestone	6	100	Willard	West.	Delco	6	Danville B.
Davis J.....	7	2050	124	34x34	3 1/2 x 5 1/2	Cont.	6	29.40	Strom.	Vacuum	B. and B.	Ow	Ow	Warner	Timken	Warner	Stewart	Firestone	6	Willard	West.	Delco	6	Davis J.
Davis H.....	7	1595	119	34x34	3 1/2 x 4 1/2	Cont.	6	25.35	Strom.	Vacuum	B. and B.	Ow	Ow	Warner	Peru	Warner	V. Sicken	Firestone	6	60	Willard	Dyn.	Delco	6	Davis H.
Dixie Flyer L.....	5	1095	112	32x33	Goodyear	3 1/2 x 5	Ow	4	16.90	1—Carter	Vacuum	B. and B.	Ow	Ow	G-L	Ow	C. A. S.	J. Man.	Ow	12	Willard	Dyn.	Conn.	6	Dixie Flyer L.
Dodge Brothers.....	5	1085	114	32x33	optional	3 1/2 x 4 1/2	Ow	4	24.03	1—Stew.	Vacuum	Ow	Ow	Ow	Ow	Ow	Ow	I. Man.	Ow	6	60	Willard	Dyn.	Conn.	6	Dodge Brothers.
Dorris 6-80.....	7	3500	132	35x55	optional	4x5	Ow	6	38.40	1 1/2—Strom.	Vacuum	B-L	Ow	Ow	Spicer	Timken	Warner	V. Sicken	Firestone	6	115	Willard	West.	Bosch	6	Dorris 6-80.
Dort 11.....	5	921	105	30x33	Goodyear	3 1/2 x 5	D-Lycro.	4	19.60	1—Carter	Gravity	Ow	Ow	Ow	Mechanics	W-Weiss	Jacox	Stewart	Jackson	6	85	Willard	West.	Conn.	6	Dort 11.
Elear.....	5	1175	116	32x33	Firestone	3 1/2 x 5	Ow	4	19.60	1—Carter	Vacuum	Mechanics	Ow	Ow	Mechanics	Salisbury	Foster	Stewart	Firestone	6	90	Willard	Dyn.	A-K.	6	Elear.
Elcar.....	5	1375	116	33x34	Firestone	3 1/2 x 4 1/2	Cont.	6	25.35	1 1/4—Strom.	Vacuum	B. and B.	Ow	Ow	Muncie	Salisbury	Foster	Stewart	Firestone	6	90	Willard	Dyn.	A-K.	6	Elcar.
Elgin Series H.....	5	1395	118	33x34	optional	3 1/2 x 4 1/2	Falls	6	23.44	1—Strom.	Vacuum	B. and B.	Ow	Ow	Mechanics	Adams	C. A. S.	V. Sicken	Firestone	6	90	Willard	Dyn.	Wagner	6	Elgin Series H.
Essex A.....	5	1395	108	32x34	3 3/4 x 5	Ow	4	18.23	1—Strom.	Vacuum	Ow	Ow	Ow	Spicer	Timken	C. A. S.	V. Sicken	Firestone	6	105	Delco	Delco	6	Essex A.
Ford T.....	5	525	100	30x33	3 1/2 x 4	Ow	4	22.50	H-K	Gravity	Ow	Ow	Ow	Ow	Ow	Ow	Stewart	12	50	Willard	Dyn.	none	12	Ford T.
Franklin 9.....	5	2450	115	33x34	Goodyear	3 1/2 x 4	Ow	5	24.50	1—Ow	Vacuum	B. and B.	Ow	Ow	Ow	Ow	Ow	Ow	12	50	Willard	Dyn.	A-K.	9	Franklin 9.

Engines—Ruten, Rutner; Cont., Continental; Weid., Weidely; North., Northway; H-S, Herschel-Spillman; Lyco, Lycoming; D-Lyco, Dory-Lycoming; G. B. & S., Golden, Belknap & Swartz; T-M-F., Teeter-McFarlan; J. & V., Root & Van Dervoort. Carburetor—Strom, Stromberg; Zen., Zenith; Ray., Rayfield; John, Johnson; Mar., Marvel; Sund., Sundman; Stew., Stewart; A-K, Holley-Kingston; Newc., Newcomb; Schab., Schaebler; Tillot., Tillotson; Johns., Johnson. Ignition—A-K, Ignition; A-K, Generator-Kent; Conn., Connecticut; Esae., Esenmann; West., Westinghouse; V-L, Villard; N. E., North East; L-N, Leece-Neville; A-C, Allis-Chalmers; Spit., Spildorf; S-N, Simms-Huff; G. & D., Gray & Davis. Gearset—G-L, Grant-Leece; North., Northway; B-L, Brown-Lipe. Rear Axle—Col., Colburn; W-W, Walker-Wheeler; C-T, K., Cadillac-Timk; West-M, West-Mott; Weston-Mott, Weston-Mott. Universals—F-H, Hartford; Th-H, Thermo-Hardy; U. M. Co., Universal Machine Co. Speedometer—J-Man, John-Manville; Y-Sicken, Van Sicken.

Name and Model	Seating Capacity	Price	Wheelbase	Rear Tire Size	Make of Tire	Bore and Stroke	Engine Make	No. Cylinders	N. A. C. C. H. P.	Carburetor Make and Size	Fuel Feed	Clutch	Gearset	Universals	Rear Axle	Steering Gear	Speedometer	Rims	Battery Volts	Battery Amp.	Battery Make	Generator Make	Motor Make	Ignition Make	Lamp Voltages	Name and Model
Geronimo.	7	1595	122	32x4	Goodyear	3 1/2 x 5	Ruten.	6	23 44	1-Stron.	Vacuum	B. and B.	G-L.	Hart.	W-Weiss	C. A. S.	Stewart	Firestone	6	83	Willard	Dyn.	Dyn.	Delco	6	Geronimo.
Glide 6-40	5	1655	119	34x4	Goodyear	3 1/2 x 5	Ruten.	6	23 44	1-Ray.	Vacuum	Own	Own	Spicer	American	Ditweiler	Stewart	Goodyear	6	80	Willard	West.	West.	Delco	6	Glide 6-40.
Grant.	5	1120	114	32x3		3x4 1/2	Own	6	21 60	Stron.	Vacuum	Durston	Durston	Mechanics	Peru	Jacox	V. Sicklen	Stanwell	6	90	Willard	Wagner	Remy	Remy	6	Grant.
Hanson	5	1685	119	32x4		3 1/2 x 4 1/2	Cont.	6	25 35	Stron.	Vacuum	B. and B.	Covert		Timken	Gemmer	Stewart	Stanwell			Pres.					Hanson
Harroun	5	995	106	30x3		3 1/2 x 5 1/2	Own	4	16 90	1-Stron.	Vacuum	Own	Mechanics		Adams	Gemmer	Stewart	Stanwell	6	80	Willard	Remy	Remy	A-K.	6-3	Harroun.
Harvard 4-20.	2	850	100	28x3		3x4 1/2		4	14 40	7/8-Zen.	Gravity			Blood		Barnes			6		National	Wagner	A-K.	6-3	Harvard 4-20.	
Hatfield A.	5	180	115	32x4	Firestone	3 1/2 x 4 1/2	G. B. & S.	4	22 50	1-Zen.	Vacuum	G. B. & S.	G-L	Spicer	Peru	Jacox	Warner	Houk	6	100	Willard	Dyn.	Conn.	Delco	6	Hatfield A.
Haynes 46.	7	3250	127	34x4	optional	2 1/2 x 4 1/2	Own	12	36 30	Ray.	Vacuum	B. and B.	Own	Own	Own	Jacox	Stewart	Firestone	6	120	Willard	L-N.	L-N.	Delco	6	Haynes 46.
Haynes 45.	7	2485	127	34x4	optional	3 1/2 x 5	Own	6	29 40	1 1/4-Ray.	Vacuum	B. and B.	Own	Own	Own	Own	Stewart	Firestone	6	120	Willard	L-N.	Ki-Rem	Delco	6	Haynes 45.
Holler 206	5	1595	116	32x4	Goodyear	3 1/2 x 4 1/2	Cont.	6	25 35	Stew.	Vacuum	Own	Own	Own	Own	Own	Stewart	Firestone	6	50	Gould	A-C.	A-C.	Remy	6	Holler 206.
Holler 198.	5	1685	116	34x4	Goodyear	3 1/2 x 4 1/2	Own	8	33 80	Stew.	Vacuum	Own	Own	Own	Own	Own	Stewart	Firestone	6	50	Gould	Split.	Split.	A-K.	6	Holler 198.
Holmes.	7	2900	126	34x4	Goodyear	3 1/2 x 4 1/2	Own	6	29 40	1-Newc.	Vacuum	B-L	Own	Spicer	Timken	Gemmer	V. S. Elgin	Firestone	12	100	Col.	Dyn.	Eise.	Delco	12-6	Holmes.
Hudson M.	7	2200	125 1/2	35x4	optional	3 1/2 x 5	Own	6	29 40	1 1/2-Ray.	Vacuum	Own	Own	Spicer	Timken	Gemmer	Stewart	Kelsey	6	87 1/2	Willard	Delco	Delco	Delco	6	Hudson M.
Hupmobile R.	5	1335	112	32x4	Goodyear	3 1/2 x 5 1/2	Own	4	16 90	1 1/4-Ray.	Vacuum	Own	Own	Detroit	Own	Jacox	V. Sicklen	Kelsey	6	87 1/2	Willard	West.	West.	A-K.	6	Hupmobile R.
Jones.	7	2100	126	34x4	Goodrich	3 1/2 x 5 1/2	Cont.	6	29 40	1 1/4-Ray.	Vacuum	B. and B.	B-L	Arvae	Timken	Warner	Stewart	Firestone	6	120	Pres.	West.	West.	Remy	6	Jones.
Jordan.	7	2475	127	32x4	U. S.	3 1/2 x 5 1/2	Cont.	6	29 40	1 1/4-Ray.	Vacuum	B. and B.	Detroit	Sterling	Timken	Gemmer	V. Sicklen	Firestone	6	109 8	Willard	Bijur	Bijur	Delco	6	Jordan.
King G.	7	2150	120	34x4	Firestone	3x5	Own	8	28 80	1 1/4-Ball	Vacuum	B. and B.	Own	Spicer	Col.	Jacox	Stewart	Stanwell	6	117 5	Willard	Bijur	Bijur	A-K.	6	King G.
Kissel Kar.	5-7	2550	124	32x4	Goodyear	3 1/2 x 5 1/2	Own	6	26 30	1 1/4-Ray.	Vacuum	Warner	Warner	Spicer	Own	Jacox	Stewart	Stanwell	6	90	Willard	Remy	Remy	Remy	6	Kissel Kar.
Kline Kar 6-42.	5	1865	121	33x4	Goodyear	3 1/2 x 4 1/2	Cont.	6	25 35	1-Ray.	Vacuum	B. and B.	G-L	Hess	Hess	Wohlhab	Stewart	Firestone	6	90	Pres.	West.	West.	Conn.	6	Kline Kar 6-42.
Lexington R-19.	5-7	1785	122	34x4	Goodyear	3 1/2 x 4 1/2	Cont.	6	25 35	1-Ray.	Vacuum	B. and B.	Warner	Hardy	Hess	Warner	Stewart	Goodrich	6	100	Willard	West.	West.	Conn.	6	Lexington R-19.
Liberty 10-B.	5	1570	115	32x4	Goodyear	3 1/2 x 4 1/2	Cont.	6	25 35	1-Stron.	Vacuum	B. and B.	Detroit	Spicer	Timken	Jacox	Stewart	Firestone	6	88	Willard	Delco	Delco	Delco	6	Liberty 10-B.
Locomobile 48.	7	142	35x5			4 1/2 x 5 1/2	Own	6	48 60	Own	Pressure	Own	Own	Own	Own	Own	Stewart	Firestone	6	120	Willard	West.	West.	Berl.	6	Locomobile 48.
Maibomb B.	5	1290	116	32x3	optional	3 1/2 x 4 1/2	Falls	6	23 44	1-Stron.	Vacuum	B. and B.	Mechanics		Peru	Jacox	Stewart	Stanwell	6	80	Willard	Wagner	Wagner	A-K.	6	Maibomb B.
Marmion 34.	7	3950	136	32x4		3 1/2 x 5 1/2	Own	7	39 50	Stron.	Gravity	Own	Own	Spicer	Own	Gemmer	V. Sicklen	Kelsey	6	120	Pres.	Bijur	Bijur	Bosch	6	Marmion 34.
Maxwell 25.	5	895	109	30x3	U. S.	3 1/2 x 4 1/2	Own	4	21 03	1-John.	Vacuum	Own	Own	Own	Own	Own	Warner	Kelsey	12	35	Pres.	S-H.	S-H.	A-K.	12	Maxwell 25.
McFarlan 127.	7	4300	136	35x5	optional	4 1/2 x 6	T-McF.	6	48 00	1 1/2-Ray.	Vacuum	B. and B.	B-L	Spicer	Timken	Gemmer	Stewart	Firestone	6	120	Willard	West.	West.	Bos. W.	6	McFarlan 127.
Mercer Series 4.	6	4500	132	32x4	optional	3 1/2 x 6 1/2	Own	4	22 50	1 1/2-Ball	Vacuum	Own	Own	Spicer	Own	Gemmer	Stewart	Firestone	6	120	Willard	West.	West.	Berl.	6	Mercer Series 4.
Mitchell E-42.	7	1675	127	34x4	U. S.	3 1/2 x 5	Own	6	29 40	1 1/4-Ray.	Vacuum	B. and B.	Own	Own	Own	Own	Stewart	Stanwell	6	100	Willard	Remy	Remy	Remy	6	Mitchell E-42.
Mitchell E-40.	5	1475	120	33x4	U. S.	3 1/2 x 5	Own	6	25 35	1 1/4-Ray.	Vacuum	B. and B.	Own	Own	Own	Own	Stewart	Stanwell	6	100	Willard	Remy	Remy	Remy	6	Mitchell E-40.
Moline-Knight L.	5	2000	117	34x4	optional	3 1/2 x 5	Own	4	22 50	1 1/4-Ray.	Vacuum	B. and B.	Warner	Spicer	Timken	Jacox	Stewart	Firestone	6	117	Willard	Wagner	Wagner	A-L.	6	Moline-Knight L.
Moline-Knight G.	7	2500	122	35x4	optional	4x6	Own	4	25 60	1 1/4-Ray.	Vacuum	Own	Warner	Spicer	Timken	Jacox	Stewart	Firestone	6	117	Willard	Wagner	Wagner	A-L.	6	Moline-Knight G.
Monitor, M. & O.	5	1475	117	33x4	Firestone	3 1/2 x 4 1/2	Cont.	6	29 40	1-Stron.	Vacuum	B. and B.	G-L		Adams	C. A. S.	Stewart	Goodrich	6	88	Willard	Dyn.	Dyn.	Conn.	6	Monitor, M. & O.
Moon 6-66.	7	2500	125	35x4	Miller	3 1/2 x 5 1/2	Cont.	6	29 40	1 1/4-Ray.	Vacuum	B. and B.	Warner	Arvae	Timken	Warner	V. Sicklen	Firestone	6	110	Exide	Delco	Delco	Delco	6	Moon 6-66.
Moon 6-36.	5	1485	114	32x3	Miller	2 1/2 x 4 1/2	Cont.	6	19 84	1-Tillot.	Gravity	Detloff	Own	Spicer	Own	Warner	V. Sicklen	Firestone	6	80	Exide	Wagner	Wagner	Delco	6	Moon 6-36.
Moore 30.	5	850	106	30x3	Firestone	3 1/2 x 4 1/2	G. B. & S.	4	22 50	1-K. D.	Gravity		G-L		Peru		Stewart	Firestone	6	80	Willard	A-L.	A-L.		6	Moore 30.
Nash 681.	5	1490	121	33x4	optional	3 1/2 x 5 1/2	Own	6	25 35	1 1/4-Ray.	Vacuum	B. and B.	Own	Own	Own	Gemmer	Stewart	Firestone	6	100	Willard	Delco	Delco	Delco	6	Nash 681.
Nash 682.	7	1690	127	34x4	optional	3 1/2 x 5 1/2	Own	6	25 35	1 1/4-Ray.	Vacuum	B. and B.	Own	Own	Own	Gemmer	Stewart	Firestone	6	100	Willard	Delco	Delco	Delco	6	Nash 682.
National 6.	7	2450	128	34x4	optional	3 1/2 x 5 1/2	Cont.	6	29 40	1 1/4-Ray.	Vacuum	Own	Muncie	Spicer	Col.	Warner	Warner	Firestone	6	110	Pres.	West.	West.	Delco	6	National 6.
National 12.	7	3050	128	34x4	optional	2 1/2 x 4 1/2	Own	12	39 68	1 1/2-Ray.	Vacuum	Own	Muncie	Spicer	Col.	Warner	Warner	Firestone	6	110	Pres.	Bijur	Bijur	Delco	6	National 12.
Oakland 34-B.	5	1185	112	32x4	Goodyear	2 1/2 x 4 1/2	Own	6	18 99	1-Mar.	Vacuum	North.	Warner	Mechanics	West-Mott	Jacox	Stewart	Perman	6	85	Pres.	Remy	Remy	Remy	6	Oakland 34-B.
Oldsmobile 37-A.	5	1295	112	32x4	Goodyear	2 1/2 x 4 1/2	North.	6	18 99	1 1/4-John.	Vacuum	North.	Warner		West-Mott	Jacox	Stewart	Perman	6	80	U. S. L.	Remy	Remy	Remy	6	Oldsmobile 37-A.
Oldsmobile 45-A.	7	1700	120	34x4	Goodyear	2 1/2 x 4 1/2	Own	8	26 45	1 1/4-Ball	Vacuum	Own	North.		West-Mott	Jacox	Stewart	Perman	6	100	Exide	Delco	Delco	Delco	6	Oldsmobile 45-A.
Olympian 45.	5	1240	112	32x3	Miller	3 1/2 x 4 1/2	Own	4	16 90	1 1/4-Ray.	Vacuum	B. and B.	Own	Own	Peru	Warner	Stewart	Perman	6		U. S.	A-L.	A-L.	Conn.	6	Olympian 45.

Engines—Ruten, Rutenberg; Cont., Continental; Weid., Weidely; North., Northway; H-S., Herschell-Spillman; Lyco., Lycoming; D-Lyco., Dort-Lycoming; G. B. & S., Golden, Belknap & Swartz; T-McF., Teetor-McFarlan; S., Mouson or Dusenberger; R. & V., Root & Van Dervoort. Carburetor—Stron., Stronberg; Zen., Zenith; Ray., Rayfield; John., Johnson; Mar., Marvel; Sund., Sunderman; Ste., Stewart; H-K., Holley-Kington; Newc., Newcomb; Schieb., Schiebler; Tillot., Tillotson. Ignition—A-K., Atwater-Kent; Conn., A-L., Auto-Lite; West., Westinghouse or Auto-Lite; W-L., Ward Leonard; Dyn., Dyneto; N. E., North East; L-N., Leese-Neville; A-C., Allis-Chalmers; Split., Splittorf; S-N., Simps-Huff; G. & D., Gray & Davis. Gearset—G-L., Grant-Lee; North., Northway; B-L., Brown-Lipe. Rear Axle—Col., Columbia; W-Weiss, Walker-Weiss; C-Tmk., Cadillac-Timken; West-Mott, Weston-Mott. Universals—Hart., Hartford; Ther-H., Thermoid-Hardy; U. M. Co., Universal Machine Co. Speedometer—J-Man., John-Manville; V-Sicklen, Van Sicklen.

Motor Age Monthly Passenger Car Specification Tables—Concluded

MOTOR AGE

June 5, 1919

Name and Model	Seating Capacity	Price	Wheelbase	Rear Tire Size	Make of Tire	Bore and Stroke	Engine Make	No. Cylinders	N. A. C. C. H. P.	Carburetor Make and Size	Fuel Feed	Clutch	Gearset	Universals	Rear Axle	Steering Gear	Speedometer	Rims	Battery Volts	Battery Amp.	Battery Make	Generator Make	Motor Make	Ignition Make	Lamp Voltages	Name and Model
Overland 90.	5	985	106	31x4	.....	3 1/2 x 5 1/2	Own	4	18.23	1-Tillot.	Vacuum	Own	Own	Own	Own	Own	Stewart	Stanwell	6	75	U. S. L.	A-L.	A-L.	Conn.	6	Overland 90.
Owen Magnetic O-36.	7	4200	127	35x5	.....	3 1/2 x 5 1/2	Boda	6	25.35	Zen.	Vacuum	Own	Own	Own	Amcr.	Own	Warner	Firestone	24	.....	Willard	Own	Own	Bosch	24	Owen Magnetic O-36.
Owen Magnetic, W-42.	7	5500	142	35x5	Optional	4 x 5 1/2	Weld.	6	38.40	Zen.	Vacuum	Own	Own	Own	Amcr.	Own	Warner	Firestone	28	.....	Willard	Own	Own	Bosch	28	Owen Magnetic, W-42.
Packard 3-25.	7	4800	106	35x5	Goodyear	3x5	Own	12	43.20	Own	Pressure	Own	Own	Own	Own	Own	Waltham	Firestone	6	120	Willard	Bijur	Bijur	Delco	7	Packard 3-25.
Packard 3-35.	7	5150	106	35x5	Goodyear	3x5	Own	12	43.20	Own	Pressure	Own	Own	Own	Own	Own	Waltham	Firestone	6	120	Willard	Bijur	Bijur	Delco	7	Packard 3-35.
Paige 6-55.	7	2000	127	34x4	optional	3 1/2 x 5 1/2	Cont.	6	29.40	1 1/2-Ray.	Vacuum	B. and B.	Own	Own	Own	Own	Stewart	Kelsey	6	108.4	Willard	G. & D.	Remy	Remy	6	Paige 6-55.
Paterson 6-39.	5	1555	117	33x4	optional	3 1/2 x 5	Ruten.	6	23.44	1-Strom.	Gravity	B. and B.	Own	Own	Own	Own	Stewart	Cleveland	6	108.4	Willard	G. & D.	Remy	Remy	6	Paterson 6-39.
Paterson 6-46.	7	1625	120	33x4	optional	3 1/2 x 4 1/2	Cont.	6	25.35	1 1/2-Strom.	Vacuum	B. and B.	Own	Own	Own	Own	Stewart	Firestone	6	80	Willard	Delco	Delco	Delco	6	Paterson 6-46.
Peerless Series 4.	7	2700	125	34x4	Goodyear	3 1/2 x 5	Own	8	33.80	Ball	Vacuum	Own	Own	Own	Own	Own	Stewart	Stanwell	12	125	Willard	A-L.	A-L.	A-K.	6	Peerless Series 4.
Phaena R.	7	5000	125	32x4	U. S.	3 1/2 x 6	Own	4	24.70	1 1/2-H. & N.	Vacuum	Own	Own	Own	Amcr.	Own	Warner	Firestone	6	.....	Willard	W-L.	W-L.	Bosch	6	Phaena R.
Piedmont.	5	1095	114	32x3	.....	3 1/2 x 5 1/2	Own	4	19.60	Carter	.....	.....	.....	.....	.....	.....	.....	Firestone	6	.....	Willard	.....	.....	.....	6	Piedmont.
Piedmont 6-40.	7	1545	120	32x4	Goodyear	3 1/2 x 4 1/2	Cont.	6	25.35	Zen.	Pressure	B. and B.	Own	Own	Own	Own	Stewart	Firestone	6	135	Willard	West.	West.	Remy	6	Piedmont 6-40.
Pierce-Arrow 48.	7	6500	142	35x5	Goodyear	4 1/2 x 5 1/2	Own	6	48.60	Own	Pressure	Own	Own	Own	Own	Own	Stewart	Goodrich	6	.....	Prent.	Delco	Delco	Delco	6	Pierce-Arrow 48.
Pilot.	7	119	32x4	Miller	.....	3 1/2 x 5	Tetor	6	28.44	1 1/2-Tillot.	Vacuum	B. and B.	Own	Own	Own	Own	Warner	Firestone	6	123.5	Willard	Delco	Delco	Delco	6	Pilot.
Premier 6-C.	7	2555	126	32x4	Firestone	3 1/2 x 5 1/2	Own	6	27.34	1 1/2-Johns.	Vacuum	B. and B.	Own	Own	Own	Own	Warner	Firestone	6	108.5	Willard	Remy	Remy	Remy	6	Premier 6-C.
Reo T.	5	1395	120	34x4	U. S.	4 1/2 x 4 1/2	Own	4	27.23	1-John.	Vacuum	Own	Own	Own	Own	Own	Stewart	Firestone	6	.....	Willard	Remy	Remy	Remy	6	Reo T.
Rever.	7	3850	131	32x4	optional	4 1/2 x 6	.....	4	30.63	1 1/2-Strom.	Vacuum	B-L.	Own	Own	Own	Own	Stewart	Houk	6	115	Willard	West.	West.	Bosch	6	Rever.
Roamer 6-54.	7	128	128	32x4	Goodyear	3 1/2 x 5 1/2	Cont.	6	29.40	1 1/2-Strom.	Vacuum	B. and B.	Own	Own	Own	Own	Warner	Firestone	6	120	Willard	Bijur	Bijur	Bosch	6	Roamer 6-54.
Saxon Y-18.	5	1195	112	32x3	Goodyear	2 7/8 x 4 1/2	Cont.	6	19.84	1-Strom.	Vacuum	Own	Own	Own	Own	Own	Stewart	Firestone	6	60	Prent.	Wagner	Wagner	Remy	6	Saxon Y-18.
Sayers Six	5	1695	118	32x4	Firestone	3 1/2 x 4 1/2	Cont.	6	25.40	1-Zen.	Vacuum	B. and B.	Own	Own	Own	Own	Stewart	Firestone	6	80	Willard	Delco	Delco	Delco	6	Sayers Six
Scrimpe-Booth 6-39.	5	1295	112	32x4	Goodyear	2 1/2 x 4 1/2	North.	6	18.90	1-Mar.	Vacuum	North.	Warner	West-Mott	J. C. W.	Own	Stewart	Perman	6	85	Prent.	Remy	Remy	Remy	6	Scrimpe-Booth 6-39.
Seneca H.	5	900	108	30x3	optional	3 1/2 x 4 1/2	LeRo	4	15.63	1-Scheb.	Vacuum	Detroit	Detroit	U. M. Co.	Adams	Ditweiler	Stewart	Prudden	6	88	Willard	A-C.	A-C.	Remy	6	Seneca H.
Singer, 19.	7	5000	139	35x5	Goodyear	4 x 5 1/2	H-S	8	33.80	1 1/2-Ray	Vacuum	Muncie	Own	Own	Own	Own	Stewart	Own	6	.....	Willard	West.	West.	Split.	6	Singer, 19.
Standard G.	7	2750	127	34x4	Firestone	3 1/2 x 5	Own	8	33.80	1 1/2-Zen.	Vacuum	B. and B.	Own	Own	Own	Own	Stewart	Firestone	6	162	Willard	West.	West.	Split.	6	Standard G.
Stearns SKL-A	5	2100	125	34x4	Goodyear	3 1/2 x 5 1/2	Own	6	22.50	1 1/2-Scheb.	Vacuum	Own	Own	Own	Own	Own	Stewart	Firestone	12	75	Willard	Remy	Remy	Remy	12	Stearns SKL-A
Stephens 76.	6	1850	118	32x4	optional	3 1/2 x 4 1/2	R. & V.	6	36.04	1 1/2-Strom.	Vacuum	B. and B.	Own	Own	Own	Own	Stewart	Kel-Stan.	6	90	Willard	Delco	Delco	Delco	6	Stephens 76.
Studebaker EG.	7	1985	126	33x4	Goodyear	3 1/2 x 5	Own	6	29.40	1 1/2-Ball	Vacuum	Own	Own	Own	Own	Own	Stewart	Kelsey	6	80	Willard	Wagner	Wagner	Remy	7	Studebaker EG.
Studebaker EH.	5	1855	119	32x4	Goodyear	3 1/2 x 5	Own	6	29.40	1 1/2-Ball	Vacuum	Own	Own	Own	Own	Own	Stewart	Kelsey	6	80	Willard	Wagner	Wagner	Remy	7	Studebaker EH.
Studebaker SH.	5	1225	112	32x4	Goodyear	3 1/2 x 5	Own	4	19.60	1 1/2-Strom.	Vacuum	Own	Own	Own	Own	Own	Stewart	Kelsey	6	80	Willard	Wagner	Wagner	Remy	7	Studebaker SH.
Stutz G.	6-7	2850	130	32x4	.....	4 1/2 x 6	Own	4	30.63	Strom.	Pressure	Own	Own	Own	Own	Own	Stewart	Kelsey	12	.....	Willard	Remy	Remy	Remy	.....	Stutz G.
Templar 445.	5	2185	118	32x4	Templar	3 1/2 x 5 1/2	Own	4	18.23	1 1/2-Zen.	Vacuum	B. and B.	Own	Own	Own	Own	Stewart	Parker	6	100	Col.	Remy	Remy	Remy	6	Templar 445.
Tulsa, D.	5	1150	117	33x4	Firestone	5 x 3 1/2	Lycos.	4	19.60	1-Zen.	Vacuum	B. and B.	Own	Own	Own	Own	Stewart	Stanwell	6	90	Willard	Dyn.	Dyn.	Delco	6	Tulsa, D.
Velle 38.	5	1465	115	32x4	Goodyear	3 1/2 x 4 1/2	Cont.	6	25.35	1 1/2-Ray.	Vacuum	B. and B.	Own	Own	Own	Own	Stewart	Firestone	6	105	Willard	Remy	Remy	Remy	6	Velle 38.
Westcott S-18A.	7	2590	125	32x4	Firestone	3 1/2 x 5 1/2	Cont.	6	29.40	1 1/2-Ray.	Vacuum	B-L.	Own	Own	Own	Own	Stewart	Firestone	6	109.8	Willard	Delco	Delco	Delco	6	Westcott S-18A.
Willis-Knight 88-4.	7	1725	121	34x4	.....	4 1/2 x 4 1/2	Own	4	27.23	1 1/2-Tillot.	Vacuum	Own	Own	Own	Own	Own	Stewart	Stanwell	6	120	U. S. L.	A-L.	A-L.	Conn.	6	Willis-Knight 88-4.
Winton 22.	7	3850	138	35x5	optional	4 1/2 x 5 1/2	Own	6	48.60	1 1/2-Ray.	Vacuum	.....	.....	.....	.....	.....	Stewart	Firestone	6	110	Willard	Bijur	Bijur	Bosch	6	Winton 22.
Winton 22-A.	7	3200	128	35x5	.....	3 1/2 x 5 1/2	Own	6	33.75	1 1/2-Ray.	Vacuum	.....	.....	.....	.....	.....	Stewart	Firestone	6	100	Willard	Bijur	Bijur	Bosch	6	Winton 22-A.

STEAM CARS

Name and Model	Seating Capacity	Price	Wheelbase	Rear Tire Size	Make of Tire	Bore and Stroke	Engine Make	No. Cylinders	N. A. C. C. H. P.	Carburetor Make and Size	Fuel Feed	Clutch	Gearset	Universals	Rear Axle	Steering Gear	Speedometer	Rims	Battery Volts	Battery Amp.	Battery Make	Generator Make	Motor Make	Ignition Make	Lamp Voltages	Name and Model
Stanley 735.	7	3450	130	35x4	optional	4x5	Own	2	.....	none	none	none	none	none	Own	Warner	Warner	Firestone	6	.....	Willard	Remy	Remy	none	6	Stanley 735.

Engines—Rutenber, Cont., Continental; Weld., Weidely; North, Northway; H-S, Herschell-Spillman; Lyco, Locomotive; D-Lyco, Dorr-Lycoming; G. B. & S., Golden, Belknap & Swartz; T-McF., Teeter-McFarlan; S., Monson or Duesenberg; R. & V., Root & Van Dervoort; Carburetor—Stromberg, Zenith; Ray, Rayfield; John, Johnson; Mar, Marvel; Sund, Sundman; Sew, Stewart; H-K, Holley-Kingston; Newc, Newcomb; Scheb, Scheller; Tiltot, Tiltotson; Johns, Johnston. Generator and Motor—A-L, Auto-Lite; West, Westinghouse; S., Westinghouse or Auto-Lite; W-L, Ward Leonard; Dyn., Dyneto; N. E., North East; L-N, Leese-Neville; A-C, Allis-Chalmers; Split, Splitdorf; S-N, Simms-Huff; G. & D., Gray & Davis. Ignition—A-K, Atwater-Kent; Conn. Connecticut; Eise, Eiscmann; West, Westinghouse; Will, Willard; N. E., North East; K-Remy, Kingston-Remy; Berl, Berling; Bosch-W, Bosch-Westinghouse; Split, Splitdorf. Gearset—G-L, Grant-Lee; North, Northway; B-L, Brown-Lipe. Rear Axle—Col. Columbia; W-Weiss, Walker-Weiss; C-Timk, Cadillac-Timken; West-Mott, Weston-Mott. Universals—Hart, Hartford; Ther-H, Thermod-Hardy; U. M. Co., Universal Machine Co. Speedometer—J-Man, Johns-Manville; V-Sicklen, Van Sicklen.

The Motor Car Repair Shop

Practical Maintenance Hints

Working a Car Into Small Space

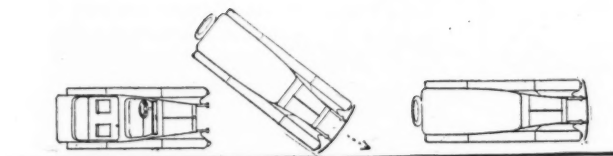


Fig. 1—The wrong method of working car into small space

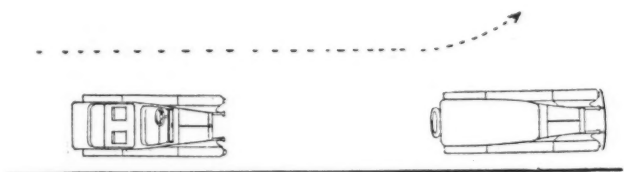


Fig. 2—First step in correct method

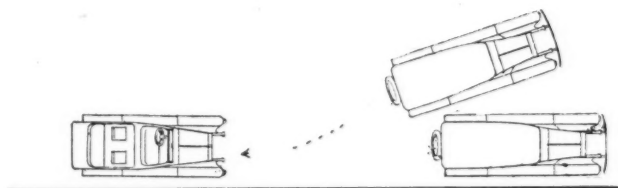


Fig. 3—Second step in correct method

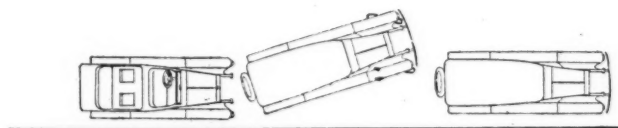


Fig. 4—Third step in correct method

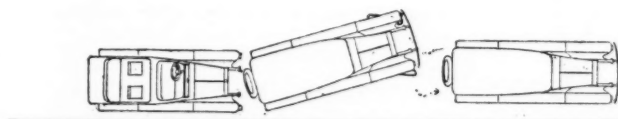


Fig. 5—Final step in correct method

NOT one driver in a hundred knows how to work a car into a small space to get near a wall or curb when it is necessary to wedge in between two cars not more than 16 or 20 feet apart. This indictment applies to old as well as new drivers, including some chauffeurs and otherwise capable demon-

strators. It is a little trick worth knowing, for it saves time and possible damage to another man's car that happens to be in the way.

As a general practice the driver attempts to go into a space head first, as shown in Fig. 1, whereas it will be impossible to work into a place by this

method, particularly if the space is limited. No amount of working around and cramping of wheels will avail unless there is ample room, and then it will take a good deal of maneuvering.

The direction of the movement of the car should be as shown in Fig. 2, a swing to the left and alongside the forward car. This will set your car in a position heading slightly out, making it possible to begin backing into the space between the two stationary cars by a movement that is best shown by the arrows in Fig. 3.

Naturally conditions will govern to some extent the exact movement and the amount of turning of the wheel, but it can be seen by this idea the car can be brought close to the curb at the back wheels, when it is easy to turn the wheels, as shown in Fig. 4. This turning of the wheels, however, should be performed while the car is still slightly under way, or else destruction to the tires may result.

The final operation comes when a movement similar to that shown by the arrows in Fig. 5 is made. In this case the front wheels should be brought from the position shown in Fig. 4 as close to the curb as possible, yet permitting room for swinging out, and then turned out slightly, followed by a straightening movement. Otherwise the body of the car will not come parallel with the curbing.

The wheels should not stand nearer than 6 in. from the curb, or it will be difficult to extricate the car from a close space.

The getting-out process is exactly opposite, that is, following the movement in Fig 5 but exactly reversed, bringing the car into the position shown in Fig 4, and from this situation it is only necessary to go ahead, swinging outward, but being careful to signal on the left that you are cutting out and into the line of traffic.

Softening Pitch

Hot water may be used for softening the pitch which seals the storage battery. A convenient apparatus consists of a can holding about 5 gal. of water and provided with three cocks to which are connected three lengths of hose which run to the openings in the three cells. The water is heated by a single-burner gas stove and when boiling hot is run into the cells until the pitch is softened. It is advisable to drain out the acid before starting. Also it is desirable to place the battery in a large pan or sink to confine any escaping water.—Connel & McCone, Overland, Boston, Mass.

Service Equipment

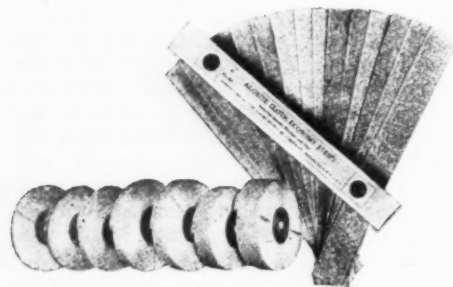
Time Savers of the Shop

Aloxite Cloth

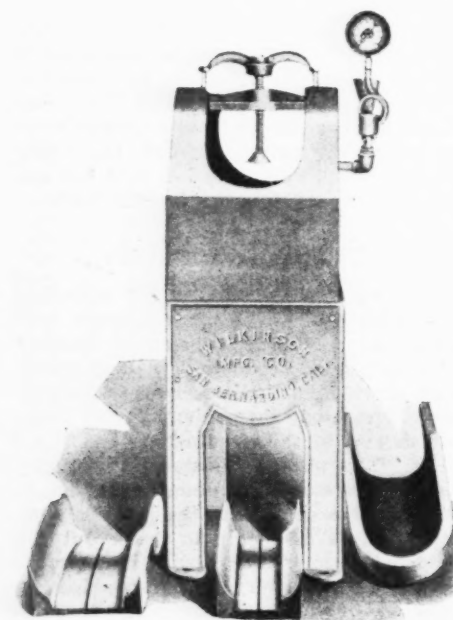
THE Carborundum Co., Niagara Falls, N. Y., is making a non-magnetic-abrasive cloth, similar to emery cloth, except that the abrasive is made of carborundum. The cloth is put up in sheet form, in 12-in. strips, and in 50-yd. rolls of any desired width and grit. The advantage of using abrasive cloth already cut in strip form is appreciated in cleaning spark and valve stems.

Stahl Rectifier

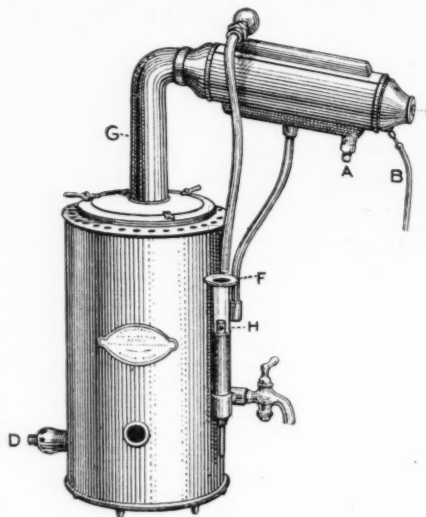
The Stahl rectifier is a miniature rotary converter. It embodies in one machine what the motor-generator has in two. The alternating current comes into a slip ring side of the synchronous motor and then passes out through the commutator, or direct current side, leaving only about 5 to 10 per cent behind, which is used in turning the armature. In principle this rectifier is the same as is used by large central electric stations in changing their alternating current to direct current. To make the machine



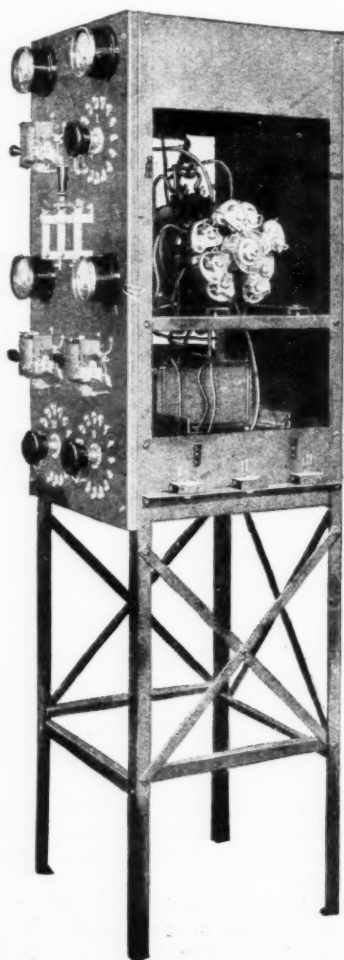
Aloxite abrasive cloth



Wilkinson truck tire vulcanizer



Barnstead water still for garage



Stahl rectifier

cheaper in operation there is provided a transformer which reduces the alternating current to its correct amount before passing through the converter. The machine has capacity for 3220 watts and can supply several sources from its distributing panels. It is made by the Stahl Rectifier Co., Chicago.

Truck Tire Vulcanizer

A vulcanizer for large pneumatic tires, 6, 7, and 8 in., is being made by the Wilkinson Mfg. Co., San Bernardino, Cal. It has the self-contained boiler and gas burner similar to the ordinary vulcanizer. It comes equipped with two head plates and a section reducer. For the service station located on a highway covered by fleet trucks, a truck tire vulcanizer should prove itself valuable. The injured tire can be left for repairs and picked up the next time that the truck passes by.

Barnstead Water Still

Distilled water for the battery repair department is an essential. The Barnstead Still, distributed by B. O. Henning, 189 West Madison street, Chicago, will provide distilled water at a very low cost to the service station. The still is made of copper and heavily coated with tin. It can be had with heating elements for electricity, gas or steam. A continuous stream of water is needed for supply and cooling purposes.

CHANGE AIRCRAFT INSIGNIA

Washington, May 30—The insignia on American aircraft has been changed and hereafter will be a red circle inside of a white five-pointed star inside of a blue circumscribed circle. The rudder insignia will be three equally wide bands, red, white and blue.

BRISCOE NOW COMMANDER

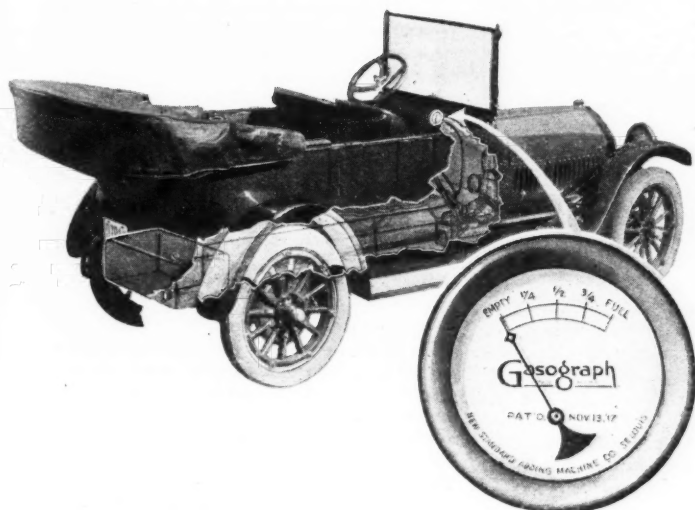
Kalamazoo, Mich., May 30—Benjamin Briscoe, president of the Briscoe Motor Corp., who is also a lieutenant-commander in the Navy, has been made a commander and has been taken from the retired list. He has been ordered to the Great Lakes Naval Training Station and will assume active duties.

HOLLIER IN PRODUCTION

Chelsea, Mich., May 30—The Lewis Spring & Axle Co. is getting into fair production on the Hollier six. Manufacture of this car, which was discontinued during the war, has been permanently resumed. The company says it can sell all the cars it makes but has not yet prepared its production schedule for the coming year. About 400 men are on the payroll and this number will be increased as production expands.

The Accessory Corner

New Fitments for the Car



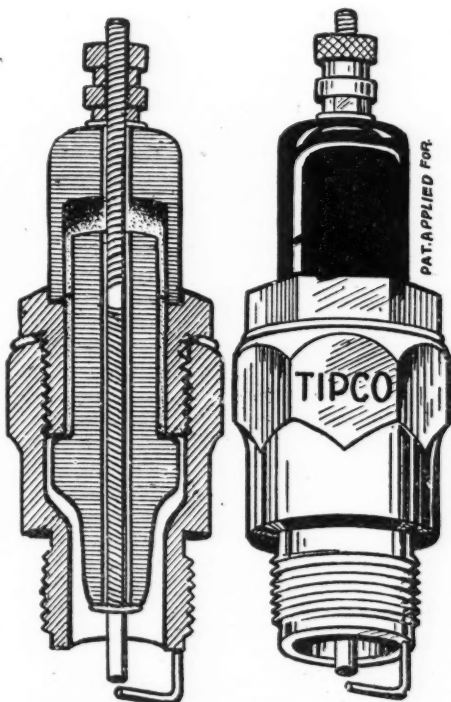
Gasograph dash dial, showing how it is installed

Tipco Spark Plugs

THE Tipco plug is different from most plugs in that the insulating material is protected from the low temperature of the outside air by a heat-insulating cap. This permits the insulator proper to become very hot all over and is not subjected to any strains which might be caused by a difference in temperature of the porcelain at the firing end and the connection end. The plug is made by the Ignition Plug Co., Louisville, Ky.

Dash Dial for Gasoline

The Gasograph, manufactured by the New Standard Adding Machine Co., St. Louis, Mo., is placed directly upon the dashboard and measures the quantity of gasoline in the tank whether the tank is located at the rear or in the cowl. Its action is dependent upon the pressure that the depth of gasoline in the tank gives. In other words, this is a pressure gage in a new form. The pressure of the gasoline caused by its weight compresses air in a small cylinder attached to the bottom of tank. This compression



Interior and exterior of Tipco plug

is recorded on the gage and instead of reading pressure is graduated to read quantity.

Mechanical Starter for Fords

The Bulldog starter for Fords made by the Autoware Corp., Detroit, is mechanical in its action. It can be applied to the car without removing the crank, because it is installed completely within the hood. The leverage reduction is great enough to allow a very easy pressure on the pedal to turn the engine over. The starter comes complete with a special primer operated from the seat, making

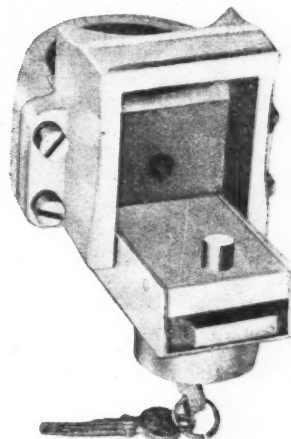
it possible to start the car easily in cold weather entirely from the seat. The starter sells for \$30.

Transformer for Ford

The Jefferson Electric Mfg. Co., Chicago, is making a transformer for Fords for operation of the taillight. This permits of the use of a small light which can be operated by batteries when the engine is standing still. The transformer cuts down the generator voltage at high speeds and makes the voltage usable for this small light. The transformer is attached to the dashboard and is wired by running the long wire of the taillight one to the magneto terminal and the third to the battery.

Shanklin's Car Lock

The Shanklin lock locks the steering wheel to the steering wheel post. With a lock of this type the car can be left with the wheels cramped over to an extreme position and then locked in this position, and if the lock is foolproof then the car can not be towed away, for the wheels cannot be straightened out. The lock is made by the Shanklin Mfg. Co., Springfield, Ill.



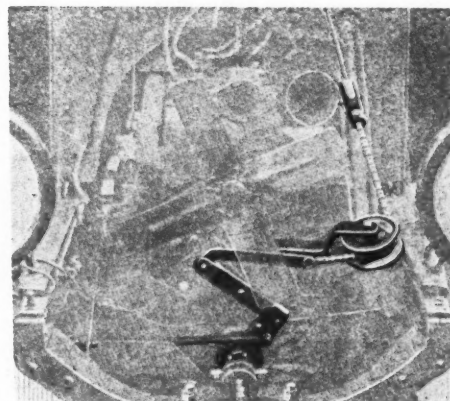
Shanklin steering wheel lock



TO MAGNETO
TO BATTERY



Jefferson transformer for Fords



Bulldog starters for Fords

Among the Makers and Dealers

Short Trade Notes

RUGGLES Resigns From Panhard—A. R. Ruggles, vice-president and production manager of the Panhard Motors Co., Grand Haven, Mich., has resigned due to ill health.

Cashin Is Standard Truck A. M.—J. G. Cashin, for four years with the Curtis Co., Detroit, has been made advertising manager of the Standard Motor Truck Co., Detroit.

Duplex Establishes Foreign Agencies—The Duplex Truck Co. has established an agency in Barcelona, Spain, and another in Copenhagen, Denmark. The company now has sixty-five direct distributors, covering every part of the United States.

Advance Adds to Plant—The Advance Pump & Compressor Co., Battle Creek, Mich., is adding materially to its plant and equipment. Building additions and new installations of machinery aggregating \$75,000 in value are being completed.

Emerson Heads Apperson Distributer—George P. Emerson, who for years has been engaged in the manufacture of parts and accessories, is president of the newly-formed Apperson-Detroit Co., which will sell Apperson cars and render service in Detroit and vicinity.

Lansing Body to Increase Plant—The Lansing Body Co. has started the erection of a new building which will double the present floor space. The new structure, which will house the painting and finishing department, has been made necessary by increasing business, which is now taxing the present quarters.

Table Maker Enters Industry—The Economy Table Co. is going into the automotive business. This company, which has been making tables, handles and other rough furniture, is now about to make motor car wheel spokes and has enough business in sight to keep the new department operating for some time.

Mills Leaves Stroh Casting—Horace Mills, director of sales of the Stroh Casting Co., Detroit, has resigned, and it is said he is interested in founding an enterprise in which he will be associated with Walter O. Adams, formerly of Olds Motor Works and more recently plant manager of the Erie Specialties Co., manufacturer of automotive products.

Auto Body Closed Big Orders—The Auto Body Co. has closed contracts for \$800,000 worth of new business. This gives the company approximately \$2,000,000 worth of business on its books and a working schedule covering more than six months. Orders are from the Olds Motor Works, the Reo Motor Car Co., Briscoe Motor Corp. and the Auburn Automobile Co.

Schwab President of Adams-Williams—F. C. Schwab, who resigned as president of the Adams-Williams Mfg. Corp. to enter Government service, was re-elected to that position at a special meeting of the directors of the company. S. H. Crittenden, who also returned from service recently, was elected vice-president. Leo W. Schwab was re-elected secretary and treasurer. Plans have been completed to

enlarge factory space and increase production this year.

Packard Declares Extra Dividend—In addition to its regular dividend of 8 per cent, the Packard Motor Car Co., Detroit, has just paid an extra dividend of 2½ per cent.

Chicago Pneumatic Tool Coming East—The Chicago Pneumatic Tool Co. will put up a ten-story brick building in New York, and will move its general offices to this city from Chicago.

Wingert Is With Fulton—A. E. Wingert, district sales manager for the Chalmers company for three years, has been appointed wholesale manager of the Fulton Truck Co. of Michigan.

Hoagland to Direct Signal Sales—M. B. Hoagland has been appointed director of sales of the Signal Motor Truck Co., Detroit. He was with the American Steel & Wire Co. for seventeen years.

Jordan Erecting New Buildings—The Jordan Motor Car Co. has commenced work on several new plant additions to its factory, which include a power plant, assembly plant, office building, japanning plant and engine test buildings.

Bassett to Represent Fulton—C. H. Bassett, Detroit, has been appointed southern district sales representative by the Fulton Motor Truck Co., Farmingdale, Long Island. In the past he has been connected with the Studebaker and Elgin interests and was a dealer and distributor at Jacksonville, Fla.

Anderson Is Lansing General Manager—Bruce E. Anderson, formerly with the Ideal Engine Co., has been appointed general manager of the Lansing Body Co., Lansing, Mich., succeeding Frank Thoman, who has retired from the management but retains his position on the board of directors.

Racine-Sattley Will Build—The Racine-Sattley Co. has purchased land adjacent to its present site and will erect a \$300,000 plant for the construction of gasoline engines, from 1½ to 15 hp. Employment will be given to 600. It was planned to construct these buildings two years ago, but postponement was forced by the war.

To Increase Marshall Starter Output—The Adrian Castings Co. is increasing its working force to increase the production of the Marshall starter which the company has been making during the last year. This is the invention of Hal Marshall, Adrian, Mich., and was manufactured for over a year by the Page Steel & Wire Co. before its construction was taken up by the Adrian Castings Co. The latter is preparing to produce 200 starters a day.

Mason Sales for Quarter \$986,911—The Mason Tire & Rubber Co. reports sales for the second quarter, ending April 30, totaling \$986,911.78 and net profits, after depreciation but before taxes of \$102,224.03. Preferred dividend requirements were \$23,300. There is \$85,000 common stock outstanding. Sales in the same quarter of 1918 were \$501,000 and net

\$63,234. Sales for 1919 second quarter show an improvement of 50 per cent over the 1918 second quarter and an increase in net of 61 per cent.

Wilson to Trademark Bodies—The C. B. Wilson Body Co. will trademark with the Wilson triangle, containing the words "Wilson-Built", all bodies turned out by its plant.

To Make Specialty of Bodies—The John Bohnet Co., Lansing, Mich., has increased its capitalization \$100,000. The company will enter the truck body field, making a specialty of hearse, delivery and ambulance bodies.

All-Power in New Home—The All-Power Truck Co., Detroit, a concern formed during the war, is now located in its new home, where there is considerable more room than in the former quarters. The company's schedule calls for 1000 trucks to be made within the next few months.

Dewey With Hydraulic Hoist—Frank H. Dewey, for some time truck engineer for the Packard Motor Car Co., Detroit, is now associated with the Horizontal Hydraulic Hoist Co., Milwaukee, as sales engineer, and has opened a Detroit office for the company.

Brooks to Represent Hudson Specialties—George W. Brooks has been appointed district representative for the Hudson Motor Specialties Co., Philadelphia, Pa. His territory will include Texas, Oklahoma, New Mexico, Kansas and Arkansas.

Luce and Storrie With Apco—T. C. Luce and William Storrie have been added to the engineering department of the Apco Mfg. Co., Providence, R. I. Mr. Luce for the last five years has been on the engineering force of the American Chain Co. Mr. Storrie was one of the early designers of Argyll cars, made in Glasgow, Scotland.

Goodrich-Lenhardt Makes Change—The general offices of the Goodrich-Lenhardt Mfg. Co. have been moved to Hamburg, Pa., where a new factory building for the company recently was completed and in which the general offices now will be located. A sales office will be maintained in Philadelphia, Pa., where it has been for the last three years.

Champion Plans 35,000,000 Plugs in 1919—The Champion Spark Plug Co. proposes to make 35,000,000 plugs this year. Last year 25,000,000 were produced as against 24,000,000 in 1917. Increased production is made possible by the enlargement of the plant through the purchase of the old Bissell Mfg. Co. buildings. The company now employs 850 in Toledo and 750 in its insulator plant in Detroit.

Doble-Detroit Sells Factory—The Doble-Detroit Steam Car Co., Detroit, has sold its three and a half story factory building to the Mutual Electric & Machine Co. The Doble company has not got into production on its steamer but is selling a steam house heating device which is being manufactured for them by the Lewis Hall Iron Works. The Mutual Electric & Machine Co. manufactures electrical controlling apparatus and also

controls patents covering the manufacture of metal parts by the cold flow process, a new method of working metal.

Leidich Manages Foreign Columbia Sales—E. Leidich has been appointed foreign sales manager of the Columbia Motors Co., Detroit. He was formerly in a similar position with the Paige company.

Hopson With General Motors—W. D. Hopson, who for three years represented the Studebaker Corp. as service supervisor in the Orient, is now service representative of the General Motors Export Co. in the Far East. He expects to sail for Shanghai June 15.

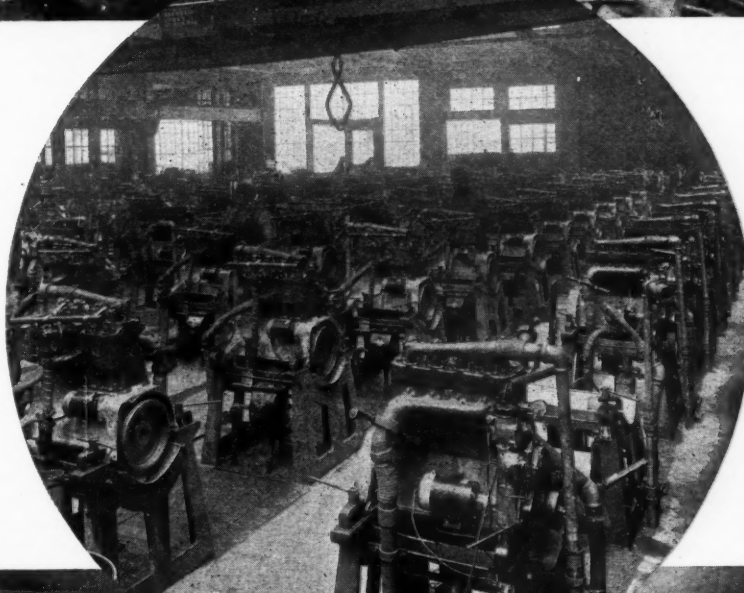
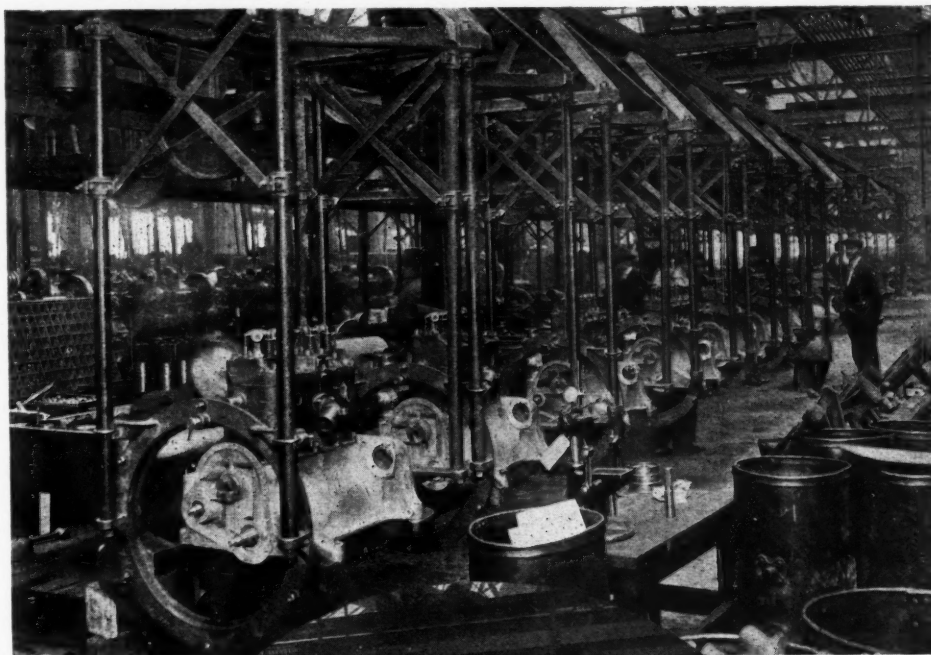
Dayton Wire Wheel Holds Convention—The officers and salesmen of the Dayton Wire Wheel Co. have concluded a convention which was held at the Dayton, Ohio, plant. Since the war ended the business of the company has increased more than thirty-five per cent, it was announced. Only a week ago a large consignment of wheels was started on its way to India.

Factory Employees Form Club—The Triangle Association, composed of the employees of four Dayton factories, the Dayton Engineering Laboratories, Domestic Engineering Co., Dayton Metal Products Co. and the Dayton-Wright Airplane Co., has formed a motor car club. Membership is open to any one in the Triangle factories who owns a car. P. B. Snyder of the Dayton Engineering department has been elected president.

Standard Detroit Will Dissolve—The Standard-Detroit Tractor Co., Detroit, has filed a petition for dissolution in the circuit court. The petition was signed by M. L. Pulcher, head of the Federal Motor Truck Co., and Edward P. Hammond, both stockholders in the company, and other well-known Detroiters. The petition states that the company has 60 cents in the bank and that its liabilities far outlay its assets. The total assets amount to \$1,811, and the liabilities, \$59,490. The company was incorporated some time ago for \$100,000 to manufacture a tractor attachment for Ford cars, but a test proved that the device was impracticable.

Liberty Building New Plant—The new factory site for the Liberty Motor Car Co. comprises twelve acres, on which three principal buildings and a power house are being erected. The administration headquarters will be 50 by 200 ft. Production offices and display rooms will be on the first floor, and executive and sales offices on the second. The second building, 60 by 320, immediately behind the first, will include a service, experimental and closed body mounting department. Back of this will be the main assembly building, which is to be 120 by 600 ft. A power house will complete present plans, but additions will be constructed as required.

Philadelphia Dealers to Play Ball—The Motor Truck Association of Philadelphia has held its last monthly meeting prior to the summer recess. A. R. Kroh, a motor truck distributor of Chicago and a farmer in Texas, spoke on "The Use of Pneumatic Tires on Heavy Duty Trucks." C. A. Musselman spoke on "The Readjustment of Labor Conditions" and Joseph P. Gaffney, chairman of the council's finance committee, explained the "City Government System." The challenge of the Camden Motor Truck Association and of the Automobile Accessories Trade Association to a baseball game on the annual outing June 21 on the Dela-



NEW CAR IN PROCESS OF ASSEMBLY
These three views are from the Essex factory and show the car in process of assembly

ware river, was accepted. J. E. Miller, chief chemist of the Barber Asphalt Pav-

ing Co., gave a talk on "Good Roads," illustrated by moving pictures.

From the Four Winds

Glimpses at the World of Motordom

CONCRETE Road for Niagara Falls—Tourists who visit Niagara Falls will welcome the announcement that the town boards of Lewiston and Niagara will at once begin the construction of a concrete highway between Niagara Falls and Lewiston.

Lands Passengers on Hotel Roof—An Army dirigible-type A-4 made a successful landing of passengers on the roof of the Hotel Statler, Cleveland, Ohio, May 24, following a flight from Akron. The dirigible discharged two passengers and took two others aboard for the return trip. The transfer was made on a landing stage built especially on the roof of the hotel.

Motors Only for Rock Island Mail—The postoffice has let the contract for handling of the mail between the postoffice at Rock Island, Ill., and all suburban points and depots to a company which will use motor vehicles only. All horse wagons will be discarded. The department has been endeavoring to secure the substitution of motor vehicles in all other cities, and, as rapidly as bids can be submitted which are regarded as reasonable, the change will be made. The contract for hauling the mails at Rock Island was let to Howard A. Klove.

Caravans for Centenary Celebration—Transportation experts engaged in the various caravans which will start for the Methodist centenary celebration to be held at Columbus, Ohio, June 20-July 13, estimate that 40,000 cars will convey approximately 175,000 visitors to the exposition. One of the largest of these will start from Springfield, Ill. More than 1000 cars will be in it. Nearly 200 cars will start from Iowa while another big caravan comes from Michigan. The caravan idea is new, and preparations for its routing and accommodation were necessary. Experts were engaged, special road maps made, lists of hotels and service stations prepared and sent to 75,000 owners. Arrangements have been completed at Columbus to park 40,000

cars at one time. The clubs of Ohio are co-operating with the centenary officials. At the celebration grounds, repairshops and service stations, accessory stores and garages will be built.

Cannonball Trail Association Formed—The Cannonball Trail Association has been incorporated, following a meeting of officers held in Galesburg, Ill. This trail is the main highway between Chicago and Quincy. Another meeting is to be held in Galesburg July 1 to discuss plans for improvements. Governor Frank Lowden and members of the state highway commission will be asked to attend.

Massachusetts Getting After Jitneys—Because of a regulation made by the Public Service Commission governing jitneys there has been a lot of trouble in Massachusetts cities lately. The board, which has jurisdiction over railroads, trolleys, etc., came out and stated that jitneys should not be allowed to operate on the roads until they had filed a bond of \$2,000 in some cases, or \$500 per passenger carried in others. Cities and towns were asked to accept this interpretation through their local councils or selectmen, and then issue license to those who applied.

Truck Service Planned by Railways—Quick freight service from Grand Rapids and all central Michigan points reached by the Michigan railway to points in Wisconsin and Illinois, is the purpose of traffic arrangements just completed between the Michigan railway, the Muskegon interurban, the Crosby line and the Chicago North Shore & Milwaukee electric railway. The truck will be the deciding factor. Freight originating on the Michigan railway will be delivered by truck to the Muskegon interurban and will be rushed through with the Grand Rapids shipments to Muskegon to catch the Crosby boat for Milwaukee. Trucks will deliver the freight from the steamboat to the electric terminal, and two trains daily will take it to Racine, Kenosha and other points along the Wisconsin shore. The truck service rates will be somewhat

higher than ordinary freight but will be considerably less than freight rates.

Wilmington May Have Show—A proposal has been made to representatives of the Wilmington Automobile Trade Assn., Wilmington, Del., succeeding the Wilmington Automobile Assn., that a motor car show be held at the Delaware State Fair, the first week in September. All of the space under the grand stand, which is really a large building, has been offered for the purpose. While definite action cannot be taken now a number of dealers have already put in bids for space. The usual winter show had to be called off this year because of inability to get a suitable building.

Canadian Clubs Prepare for Season—Canadian motorists' clubs on the Niagara frontier are planning a busy summer season. The Dunnville, Ont., club has been active in working for permanent improvement of the Hamilton-Port Dover road and announces that contracts have recently been let for paving thirteen miles of this highway. New officers of the club are W. J. Griffith, president; O. E. Willson, vice-president; T. J. McCutcheon, secretary-treasurer. The Saint Catharines, Ontario, club is planning to boost good roads and will replace road signs in this city's vicinity, these having become dilapidated during the war. This club's new officers are T. J. Petrie, president; A. H. Wallace, vice-president; R. W. G. Connolly, treasurer.

Tractor Ruins Drugstore—William Schneider of the firm of Berney & Schneider, Lenox, Mich., gave a realistic demonstration of the efficiency of a creeping tractor recently. To prove to the natives just how well it would take a steep grade, he started up a 45-deg. hill to the sidewalk in front of the Lutes drugstore. The tractor started up the incline and never hesitated. It tilted its nose in the air and tossed Schneider off the back as it trundled across the sidewalk and through the plate glass window of the store. When Schneider caught the runaway it had ploughed its way through a showcase and was headed for the prescription counter. He shut off the gas but the damage will amount to \$300. He convinced the village, however, of the strength of the iron horse.

Indiana Roads Slated for Improvement—Work on the construction of Indiana roads will be begun at once, according to H. K. Bishop, engineer of the state highway commission. The first roads to be improved will be the National road in Marion county West of Indianapolis and a stretch of road extending from South Bend to the Michigan state line. The construction work this summer will be confined to the main market highways which follow the following routes: The National road from Terra Haute through Indianapolis to Richmond, a road from the Illinois line in Lake county to South Bend and thence to Fort Wayne, a road from Vincennes to Mitchell, a road from Evansville, through Seymour to Lawrenceburg, and a North and South road from Jeffersonville to South Bend.

Coming Motor Events

MEETINGS

Hot Springs, Va. Automotive Equipment Association June 2-6
Ottawa Beach, Mich. Society of Automotive Engineers June 23-27

TRACTOR DEMONSTRATIONS

Denver, Col. Sectional Tractor Demonstrations June 8-14
Wichita, Kan. Automotive Committee of National Implement Assn. July 14
Aberdeen, S. D. Sectional Tractor Demonstrations August 18-22
Ottawa, Ont., Canada Inter-Provincial Plowing Match and Tractor Demonstrations October

RACES

New York June 14
Tacoma, Wash. July 4
Cincinnati, Ohio July 5
Uniontown, Pa. July 19
New York July 26
Elgin, Ill. Aug. 22-23
New York Aug. 23
Uniontown, Pa. Sept. 1
New York Sept. 20
Cincinnati, Ohio Oct. 1